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SELECTIONS FROM THE RECORDS OF THE BOMBAY GOVERNMENT.
No. XIV.

REPORT

ON PROPOSED

CANAL AND RAILWAY

IN

SCINDE,

BY

LIEUTENANT CHAPMAN;

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ac

WITH

ACCOMPANYING LETTERS

BY

MAJOR H. B. TURNER AND H. B. E. FRERE, ESQ.

Bombay:
PRINTED FOR GOVERNMENT
AT THE
BOMBAY EDUCATION SOCIETY'S PRESS.

1854.

INTRODUCTION.

THE meritorious young Officer whose two valuable Reports constitute the most important part of this No. of the Selections did not, it will be seen, long outlive their completion. On the 5th January the Government of Bombay received the following communication from Mr. H. B. E. Frere :—

No. 514 OF 1853.

REVENUE DEPARTMENT.

From the COMMISSIONER IN SCINDE,

To the RIGHT HONORABLE LORD VISCOUNT FALKLAND,
Governor and President in Council, Bombay.

Dated 27th December 1853.

MY LORD,

It is with feelings of the most sincere sorrow that I transmit, for the information of your Lordship in Council, the enclosed copy of a letter from Captain Hodgkinson, Deputy Magistrate in charge Suddur Station, Hydrabad, and extract of a letter from Captain Ethersey, Superintendent Indus Flotilla, giving an account of an accident to a boat on the river Indus, during the night of the 21st—22nd instant, which cost the lives of Lieutenant Chapman, Engineers, and of several of his establishment.

2. Lieutenant Chapman had examined the Lukkee Pass in company with Major Turner, in order to select the best line for a road over it; and, after parting from Major Turner, was on his way back to Kurrachee, to prosecute his survey of a line for a railway to Kotree, when the accident occurred.

3. Of the accident itself, I am unable to add any further details to those which will be found among the enclosures, except that I am informed four more of the Native followers got ashore, at some distance down the river, and reached Hydrabad, subsequent to the date of Captain Hodgkinson's letter.

4. It was from a faint hope that Lieutenant Chapman might have escaped in a similar manner, that I have forborne sooner to report this lamentable occurrence; but all hope is now, I regret to think, at an end—though the strictest search has hitherto failed to ensure the recovery of Lieutenant Chapman's body.

5. Of the extent of the loss the Public Service has sustained by Lieutenant Chapman's death, I need hardly inform your Lordship in Council; for the records of Government, and the high estimation in which he was held by every Officer of his own distinguished Corps, alike testify to professional abilities and

energy of no common order, of which he has left a less perishable monument in the new road over the Thull Ghaut. Nor do I think that the warmth of personal regard for a character in which manly frankness was combined with a singular amiability in every social relation, has more than its due weight, when I view the early death of this most promising and lamented young Officer as a public calamity to the province, the improvement of which had been, since he landed in it, the constant object of his professional labours,—labours which, your Lordship had lately an opportunity of judging, were as remarkable for the zeal as the judgment which directed them.

I have the honour to be, &c.

(Signed) H. B. E. FRERE,
Commissioner in Scinde.

Commissioner's Office, Camp Moollane, Kateear, 27th December 1853.

(Copy.)

To the COMMISSIONER IN SCINDE,
On Circuit.

Dated Hydrabad, 22nd December 1853.

SIR,

I deeply regret that, in the absence of the Collector on Circuit, it falls to my lot to announce to you the melancholy fate which has in all probability befallen Lieutenant Chapman, of the Engineers, his Serjeant, and other public followers. Early this morning a messenger arrived in Hydrabad, with the intelligence that a boat from Sehwan, having on board Lieutenant Chapman, a Serjeant (name unknown), and 27 public and private followers, had sunk in mid-channel in the Indus, not far from the small village of Jam-ka-Loda, about 3 miles from Hydrabad. On arriving at the spot, I found Mr. Chapman's Hamall, a Puttewallah, and eleven Kalasees employed under Lieutenant Chapman, who had escaped. From their report it appears, that by desire of Mr. Chapman the boat got under weigh when the moon rose last night about 11 o'clock, and pursued its way to Kotree for about an hour, when she struck against a sunken tree, and immediately went under water,—four persons were washed off,—but she rose to the surface, and two hours elapsed before she finally sunk. Their cries for assistance were heard at length by the people in the village of Jam-ka-Loda, and a small boat put off to their assistance. The first rope thrown they missed; the second was caught, but it broke; and before a third could be procured the boat had disappeared. Fourteen, as above mentioned, were carried down by the current, and ultimately reached the shore; nothing has been heard or seen of the others. No bodies have been recovered, but I much fear little or no hope remains of their safety. I sent mounted Policemen down the banks, and also a boat across to the other side of the river, in case the current should have drifted them in that direction. The Kardar of Dooaba, Foujdar, Russaldar of Police, and others, are still engaged in

the search, but up to this moment no intelligence has been received of the missing. Should further intelligence reach me, I will report for your information or through the Collector at once. To the latter I have sent off an express with the melancholy tidings. It has been ascertained by sounding that the boat sank in about 10 feet water, and boats have been ordered from Kotree with grappling hooks, &c. to secure what can be recovered from the wreck. Whilst the slightest hope of their safety remains it would not be, I thought, advisable to make a formal report of the occurrence, but I deemed it my duty to make known to you at once what had occurred.

I have, &c.

(Signed) C. HODGKINSON, Captain,
Officiating Deputy Collector.

½ *past* 1 P. M.

(True copy)
(Signed) B. H. ELLIS,
Assistant Commissioner.

Subjoined is a brief statement of this lamented Officer's services :—

Lieutenant Chapman arrived from England in March 1844, and in the following June joined the Department of Roads and Tanks as a 2nd Assistant, and was placed in charge of the works on the Agra Road, from the foot of the Thull Ghaut to Chandore. In 1846 he submitted plans and estimates for the completion of the new road over the Thull Ghaut, a portion of it having been previously constructed by him to ascertain rates. The plans and estimates were sanctioned by Government on the 12th October 1846. The work was completed in May 1849, and a Special Committee of Engineer Officers was appointed to report upon it, which they did in the following terms :—

"The Committee, having most carefully inspected the whole line of Ghaut road, including every bridge and every drain most minutely throughout, are of opinion, that bearing in mind the amount of the general expenditure on these works, the construction is very perfect, and reflects the highest credit on Lieutenant Chapman."

In December 1849 Lieutenant Chapman forwarded, through the Superintendent of Roads and Tanks, to the Military Board, statistical tables regarding the traffic on the Thull Ghaut; and the Military Board, in forwarding them to Government, remarked:—"We cannot too highly praise the forethought, industry, and zeal which have led Lieutenant Chapman to take advantage of the opportunity afforded him of acquiring the information he has condensed into these valuable documents. Many an Officer, even if requested to collect it, would have raised difficulties, advancing want of time, establishment, or some such excuse; but this is a purely gratuitous contribution.

"The Chief Engineer avails himself of the present occasion to bring the subject of Lieutenant Chapman's claims again to notice, and we would strongly recommend that this Officer be appointed to the vacant 1st Assistantship in the Road and Tank Department, as he has shown remarkable ability, and, what is more to his credit, remarkable industry and zeal in the execution of the duties committed

to him at the Thull Ghaut; and we trust it will be considered a satisfactory circumstance that Government have it in their power to give an immediate and substantial mark of appreciation without creating any inconvenient special case."

Government replied to this by appointing Lieutenant Chapman 1st Assistant, declaring that "to mark the approbation with which Government views that Officer's persevering industry and professional ability, His Lordship in Council is pleased, as recommended by you (the Military Board), to appoint him to the vacant 1st Assistantship in the Road and Tank Department."

Amongst the works constructed by Lieutenant Chapman on the great Agra Road was the Undwell Bridge, having a single arch of 100 feet span, and respecting which the Military Board observed, in their letter to Government No. 6703, of the 16th August 1851:—"It is a most satisfactory fact, that a bridge of so large a span, built of rubble stone, should be thus proved to be perfectly trustworthy, and we trust it will lead to the construction of others in the same manner, in supersession of timber bridges.

"Lieutenant Chapman deserves great credit, and we would recommend that his name, and the cost of the bridge, be recorded on the structure, as proposed by the Superintendent of Roads."

In September 1851 Lieutenant Chapman went to England. He returned in October 1852, and in the following month was appointed to the special duty of inquiry and survey with a view to the construction of a navigable canal between the Indus and Kurrachee, which inquiry resulted in the two Reports now published.

The Reports on the canal and railway were received by Government on the 24th of November, and the requisite survey to enable Lieutenant Chapman to lay down a line for the proposed railway immediately sanctioned. On the receipt of the order to prosecute his survey, Lieutenant Chapman hastened down the Indus, when on the night of the 24th December the melancholy accident occurred which has deprived the Government and the province of Scinde of his services.

On the receipt of Mr. Frere's letter, Government expressed its regret by the following Resolution and Notification:—

RESOLUTION.

It is with much regret Government learn the loss of so accomplished and excellent an Officer; and with a view of commemorating his services, it resolves to call the road which Lieutenant Chapman constructed up the Thull Ghaut by his name.

NOTIFICATION, GENERAL DEPARTMENT.

"With the view of commemorating the services of the late Lieutenant Chapman, of the Engineers, the Right Honorable the Governor in Council has resolved that the road up the Thull Ghaut, constructed under the superintendence of that Officer, shall in future be called "Chapman Road Thull Ghaut."

By order, &c.

(Signed) C. J. ERSKINE,
Acting Secretary to Government.

Bombay Castle, 28th January 1854.

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No. 459 of 1853.

Territorial Department,
Revenue.

From the COMMISSIONER IN SCINDE,

To the Right Honorable LORD VISCOUNT FALKLAND,
Governor and President in Council, Bombay.

Dated 16th November 1853.

My Lord,

During the past season Lieutenant Chapman was employed, under the orders noted in the margin, to examine a project, submitted to the Supreme Government by Colonel Outram in 1840, for improving the Kulleeree Canal between Tatta and Gharra, and thereby to give good water-carriage by river-boats between Kurrachee and the Indus, without passing through the Delta.

From Government, No. 4711, of 12th July 1852.
Ditto, No. 5990, dated 11th September 1852.

2. In the course of the season it became manifest that works of considerable extent would be required; and therefore, at my request, Lieutenant Chapman extended his inquiries to the somewhat wider question of how the best communication could be secured between Kurrachee Harbour and the river Indus above the Delta.

3. I have now the honour to transmit a letter from Major Turner, Superintending Engineer, forwarding the Reports in which Lieutenant Chapman details the results of the season's work, and the plans with which he illustrates them.

From the Superintending Engineer, No. 2654, of the 15th instant.
From Lieutenant Chapman, of the 1st November 1853.

4. The first part of his Report details his propositions for securing good water communication by a canal to Jerruck, which he estimates will cost about fifty and a quarter lakhs of rupees, and make a direct return of 4 per cent.

5. The second part gives an approximate calculation of the cost and returns of a railway to Kotree, with a branch to Jerruck, which he estimates will cost about fifty-six and a half lakhs of rupees, and make a direct return of 5 per cent.

6. In both cases the estimate of cost appears to Major Turner ample to cover all possible contingencies, while the estimate of returns, which I have also gone over with the Superintending Engineer, appears to us to be much within the amount at which it might fairly have been set down.

7. Lieutenant Chapman has taken no credit for the certain increase of trade. The traffic, which, if the canal or railway now existed, must adopt its line, and would, as Lieutenant Chapman shows, pay 4 or 5 per cent., as the case might be, is increasing steadily at the rate of 20 per cent. per annum.

It will, in all probability, by the unaided result of causes now in operation, be 60 or 80 per cent. greater than at present before the line can be possibly opened, however speedily it may be commenced; and the making, and, still more, the opening of the line, will, of course, give it a vast impetus.

8. Nor has Lieutenant Chapman taken credit for anything which was not before him officially, *e. g.* the vast amount of Commissariat and other Government stores now in progress to the Punjaub, or expected, such as 10,000 barrels of porter this year, 3,000 tons of iron expected next season for a bridge at Attock—facts which might have materially swelled his prospective returns.

9. He might also have fairly taken credit for the saving his projects, if carried out, will effect in such heavy items of expense as wear and tear of tents and camp equipage, deterioration of stores by delay and exposure, and the saving in the local expenses of the Commissariat which will be possible when a vessel can discharge direct into a railway truck, which will a few hours afterwards deliver its contents on the river bank at Kotree,—a point to reach which at present occupies generally a month at least, and often much more.

10. I therefore consider Lieutenant Chapman's estimates quite on the safe side; and I believe he might, without rashness, have greatly enhanced the amount of his prospective returns.

11. As regards the extraordinary facilities which the line presents for either canal or railway, I may be allowed to add my testimony, as an unprofessional traveller, to the more competent testimony of both Engineer Officers. I have certainly never seen a country with superior facilities for the easy and cheap execution of such works.

12. Of the two projects I prefer the railway, as being the more perfect means of attaining the desired object, as regards position of the river terminus, speed, and cheapness; as the more profitable; the less liable to mishaps from unforeseen accidents, and caprices of the river; the more comprehensive, as regards the classes of traffic it will accommodate; but more especially because there is no rival or alternative means of communication which can compete with it: whereas the success of a canal would be the most certain means of ensuring the speedy rivalry of a railway.

13. Moreover, a railway would meet with ready support from capitalists at a distance, who would be less likely to view a canal as a favourable investment.

14. Such capitalists are, I believe, prepared to find the means of carrying out a railway over the line in question, as soon as they hear that the scheme is approved of and supported by Government as sound in itself, and that the Government of India is willing to extend to the undertaking the usual guarantee of interest.

15. Mr. Hardy Wells, a Civil Engineer now employed in the province, was so struck by the facilities for constructing a railway over the line in question, when he traversed it on duty last year, that he communicated his observations to friends at home, and supported them by sections of most of the watercourses, which Major Turner procured for him, and by Custom House and Traffic Returns. The result has been that a Company is now, as I learn from him, in course of formation in England, with a view to undertake the line, if supported by Government in the manner above alluded to.

16. I quite concur in the opinion expressed by Lieutenant Chapman, that if the line were entrusted to such a Company, under the guidance of a single Managing Director, unencumbered by a large Board of Directors at a distance, but with the aid and control elsewhere furnished by Government officials, the work might be completed with a speed and economy hitherto unknown in such undertakings; for this simple reason, that there is here a total absence of all adverse or conflicting interests, and of all competing modes of transit.

17. The next step to be taken is to obtain detailed plans and surveys, such as may show the precise line to be taken, and, as nearly as possible, the exact cost of the works.

18. In my separate letter of this date I have detailed the steps I have taken for the purpose of enabling Lieutenant Chapman to complete such surveys and estimates, in anticipation of the wishes of Government, by whom the steps taken will, I trust, be approved.

No. 456, of the 16th instant.

19. It is hardly necessary for me to bring to the favourable notice of your Lordship in Council the mode in which Lieutenant Chapman has performed his duty : the energy and accuracy with which his data have been collected, and the clear and comprehensive manner in which the results are stated, fully sustain the professional reputation he had previously acquired ; while his conscientious abstinence from all over-sanguine statements cannot be too much commended.

20. The very satisfactory mode in which the duty entrusted to Lieutenant Chapman has been performed is, I believe, in no small degree owing to the effective support and assistance he has in every case met with, and the valuable advice he has received from Major Turner, the Superintending Engineer.

I have the honour to be, &c.

(Signed) H. B. E. FRERE,

Commissioner.

Commissioner's Office, Kurrachee, 16th November 1853.

No. 2654 OF 1853.

PUBLIC WORKS. REVENUE DEPARTMENT.

To the COMMISSIONER IN SCINDE.

SIR,

The projects I have now the honour to lay before you have been drawn up by Lieutenant Chapman, of the Engineers, specially appointed by Government, with the sanction of the Most Noble the Governor General of India, to the duty of making such a detailed survey of the country as would enable him to submit a project for "a constantly navigable channel between Kurrachee and the Indus."

2. Such a canal has been the great desideratum ever since the first occupation of Scinde by the British Government; and so far back as the year 1840 the late Lieutenant Colonel LeMessurier submitted a project for accomplishing it by opening the Kulleeree Canal and the Gharra Creek, which attracted some attention at the time, and was printed by the Supreme Government.

3. As the commerce and the traffic of the country have increased, so also have the risk and inconvenience of the existing means of communication become more apparent; and it has now become absolutely necessary to improve those means, in order to meet the urgent demands of Government and of the public, for the conveyance of stores and merchandize to the countries through which the Indus and the other rivers which fall into it flow, as well as to enable the produce of those countries to be brought to a market.

4. During the last two years the necessity for such means have become even more pressing: unusually heavy falls of rain and high inundations have closed the direct land route to the river for many months in each year, while the constant changes inseparable from all delta navigation threaten at no distant period to cut off the communication from Kurrachee to the river through the tidal creeks altogether; besides which, the opening of the harbour to English merchant shipping, arising from improved knowledge of its capabilities, has created a disposition to carry on trade direct with England, instead of through the port of Bombay.

5. Moreover, Government are in a variety of other ways directly interested in improving the means of communication: the existing state of matters cripples the enterprise of the cultivators, and in many places limits the extent of cultivation to the local demand. You will remember a fact brought forward in my Report on the Roads in Scinde, dated the 30th March 1852, that at Narree I found stocks of Government grain of three years' standing, which, though repeatedly submitted to public auction, nobody would buy, in consequence of the cost of conveying it to a market: the grain was eventually destroyed by the inundation of 1851. The effects of improved communication on cultivation were very clearly explained in a late American journal: wheat, valued in that country at $49 50c. at the nearest market, if carried 330 miles by ordinary highway, cost in conveyance its full prime cost, and its value was therefore doubled; while if conveyed by railway the same distance it would have cost in carriage no more than $5. In cheaper kinds of grain, the cost price, $24 75c., would be expended in carriage, if conveyed only 160 miles by highway, whereas it would have cost $2 40c. only to have conveyed it to the same distance by railway. In Scinde the

proportion the cost of conveyance bears to the price of grain on the spot where it is grown is much greater, and it could be easily proved, that in parts of the country at even short distances from markets where the demand is not limited by local consumption, the cost of carriage to that market is so great, that it is unprofitable to cultivate, and that the cultivation is therefore checked, and limited to the consumption of the immediate localities.

6. During the course of Lieutenant Chapman's inquiry, it became apparent that objections existed which were fatal to Lieutenant Colonel LeMessurier's project, or to any use being made of the greater part of the Kulleeree Canal; and as the cost of cutting a new canal would in any case be large, it was supposed that a railway might prove the less expensive of the two. Lieutenant Chapman's instructions were, therefore, modified, at your request, to the extent of requiring him to report on the most advantageous means of communication between Upper Scinde and Kurrachee, whether by railroad or canal.

7. Two distinct projects have been submitted: the *1st*, for a canal from Jerruck on the Indus to Kurrachee Harbour, which has been framed from actual survey and careful measurement; the *2nd*, for a railway from Kurrachee to Kotree on the Indus, drawn up, not from actual survey, but from a general knowledge of the country, derived, partly from personal examination, and partly from inquiry from others. Before, therefore, a railway could be commenced, a similar detailed survey must be made to that which has been completed for the canal, and the estimate for the railway now transmitted must be considered a mere approximation, prepared only for the purpose of comparison with tha of a canal.

8. With respect to the canal project, a perusal of Lieutenant Chapman's Report will, I am confident, convince you, as it has me, that the best, if not the only safe position for the canal-head is the rocky bank of the river at Jerruck; that it will not be profitable to make use of any part of the Kulleeree, though the Kulleeree may be made more profitable by the proposed new canal; that the communication will be imperfect if the canal stop short at Gharra; and that to derive full advantage of it, it should undoubtedly be carried into Kurrachee Harbour, as proposed.

9. The section of the canal, the description of vessels to navigate it, and the position and dimensions of the locks, have all been judiciously determined; but if the locks are not long enough to take in the larger description of accommodation boat, they should to that extent be lengthened, as those boats are well adapted for the river work, and it would save much transhipping if they could be used in the canal as well.

10. At the commencement of the canal near Jerruck the cutting is necessarily heavy, in order to place the bed of the canal low enough to be fed by the river when at its lowest level, but from the eighth to the fifty-fourth mile it is almost impossible to conceive a more favourable line for a canal: the first level is carried 25 miles; the next, which is only 5 feet lower, extends 25½ miles further, where a second fall of 5 feet becomes necessary; and the third level extends to the thirty-first mile, close to Kurrachee. In parts of this portion the embankments are very heavy, but the nature of the ground will not admit of any better line.

11. Lieutenant Chapman has given detailed plans of his canal-head and regulating lock. Plans for all the other works have been prepared roughly, and have been examined by me: they are in the same detail, and exhibit the same care and skill which has been displayed in the design for the canal-head.

12. The rates Lieutenant Chapman has adopted will, I believe, be found sufficient, with good superintendence; and I can perceive in the project no engineering difficulty that has not been foreseen and provided for.

13. Having carefully examined the country through which it is proposed the railway shall pass, I can assure you that it is admirably adapted fo such a work:

it consists of a number of level, or nearly level plains, with a generally hard and smooth surface. Abundant stone will be found along it for ballasting, as well as for stone blocks, should they (as I believe will be the case) be found preferable to wooden sleepers. I have not so high an opinion of the Scinde babool as Dr. Baynes has, having seen frequent instances of the destruction of the heart as well as of the sap wood by white-ants. The measured distance of the present road is 100½ miles, so that in taking 110 miles I conclude Lieutenant Chapman provides for extending it to Keeamaree, and the town, but even then 110 miles is a very ample allowance.

14. I approve of Lieutenant Chapman's proposal to extend the line of railway to Kotree: Hydrabad and Kurrachee are two of the three principal towns of Scinde, and should be united, and, for the reasons given in the 1st to 3rd paragraphs of his Report, I do not think any communication from Kurrachee to the river by railway short of Kotree would pay.

15. The two objections raised to Kotree as a terminus I do not consider of much moment: the Bahran has yet to be examined, and I believe, that at an inconsiderable distance to the west of the direct line, a rocky bed for the foundations of the bridge will be discovered, and there is no doubt that if the bank of the river above Kotree were faced with dry rubble, it would be quite safe. The cost of the measure is at present the difficulty: when a railway has been laid down from the hills, that difficulty will be removed.

16. Great credit is due to Lieutenant Chapman for the labour and forethought with which, in so short a time, he has succeeded in getting together so much valuable information, and for the business-like manner in which he has collated and arranged it. In neither of his projects has he made the most of the facts he had adduced: not only has he discarded all information not strictly official, but he has used the official returns with the greatest caution; and with the knowledge that it has been a very common practice in England, when framing traffic returns, to double all the existing traffic, and that the result has generally shown that the projectors have been by no means too sanguine, I am certain a much larger return might very fairly have been promised. For instance, the commerce of Scinde has been found, without the stimulus of improved means of communication, steadily to have increased at the rate of 20 per cent. per annum: the removal of all transit duties will certainly tend to increase the commerce still more rapidly; yet, notwithstanding the Deputy Collector asserts that by the time the railway could be opened (say four years hence) the trade will be doubled, Lieutenant Chapman has not taken any credit for even the ordinary per-centage of increase due to the years the railway must be in progress. So, again, with respect to taxing the boats: he proposes not more than the actual saving of food to the crews, whereas decrease of wear and tear, the absence of risk, saving of time, and consequent preservation of perishable goods, are all advantages, which would willingly be paid for.

17. In the single item of 10,000 casks of ale and porter now being sent to the Punjaub, I am confident a large profit could be shown, either in the canal or railway project; while, as the length of voyage would be decreased some twenty-four days, there would be a much better chance of its arrival at its destination in good order. In the Commissariat, too, the saving of expense would be immense, were there direct communication from the harbour to Kotree.

18. Many other sources of revenue derivable from the canal project are enumerated in the 85th paragraph of the Report, yet, in estimating the profits of the scheme, Lieutenant Chapman has omitted them all.

19. But, as the same principles have been adopted in estimating the returns from both schemes, their profits may, perhaps, safely be compared, and, as an investment for capital, the railway seems to promise the best. The chief objections to the canal are its terminus on the river being short of Kotree, and its liability to ruin in the event of a

railway being hereafter established: both these objections are irremediable, for there is no spot in the vicinity of Kotree fit for a canal-head; and in the present days of improvement, it would be wrong to promise a monopoly to the canal, when a few years hence will most probably show that a railway is absolutely necessary. As a matter of local improvement, I prefer the canal. The advantage of so large and certain a supply of Indus water is a benefit that in countries blessed with rain cannot be appreciated. Moreover, for the present wants of the province, and the existing race of people, I am inclined to believe the canal is best adapted; but, looking forward to a time when the railway will probably extend up the valley of the Indus to the Punjaub, I believe the railway from Kurrachee to the river ought to be adopted in preference to the canal.

20. Should you concur in the opinions I have expressed, I trust you will be able to induce Government to permit Lieutenant Chapman to make the requisite survey, to enable him to lay down a line for the railway this season, supplying him with the assistance he has represented to be necessary to enable him to do so.

21. I would also venture to express a hope, that as the Reports are of public interest, both in Scinde and in England, Government may be induced to print them, in which case I would send you a sketch map of the country, including Kotree, on a convenient scale.

I have the honour to be, &c.

(Signed) H. B. TURNER, Major,
Superintending Engineer, Scinde.

Kurrachee, 15*th November* 1853.

CANAL REPORT.

No. —— OF 1853.

From LIEUTENANT CHAPMAN, Engineers,
On Special Duty, Scinde,

To the SUPERINTENDING ENGINEER,
Scinde.

SIR,

Having been appointed, under the sanction of the Supreme Government, to the duty of "examining the ground between Kurrachee and the Indus, with a view to forming a constantly navigable channel," which instructions have since been extended, with the sanction of the Commissioner in Scinde, and yourself, to "a consideration of the most advantageous means of communication between Upper Scinde and Kurrachee," I have now the honour to submit my Report, treating the subject according to the modified directions, and consequently embracing, in addition to the several means of communication by water which present themselves, the consideration of the comparative advantages derivable from the substitution of a railroad.

From A. R. Young, Esq., Under-Secretary to the Government of India, to the Chief Secretary to Government, Bombay, No. 661, of 20th August 1852; and Mr. Chief Secretary Malet's letter, No. 7228 of 1852, dated November, to the address of the Chief Engineer, Bombay.

1. The Indus, the great commercial highway of Scinde, though invaluable as a means of communication from Jerruck upwards, is subject, in common with all delta rivers, to constant changes, both in the direction and depth of the many channels by which its waters are discharged into the sea, owing to their volume not being sufficiently concentrated, either in direction or power, to enable it to overcome the opposing force of tides and currents, which compel the deposition of the matter held in suspension by its waters, in the shape of bars and sand-banks, at its mouth.

The necessity which exists for the improvement of the Communication.

But, in addition to the disadvantages to navigation which this characteristic implies, the Indus, for the last 100 miles nearly of its course, passes through a flat of deep alluvial soil, which offers no resistance to the action of the periodical floods; and here, again, the changes in its bed are so contant and considerable as to increase in a material degree both the risk and delay of transport.

2. It is owing, probably, to these peculiarities, that though Scinde appears always to have enjoyed a considerable coasting trade, no delta port, even under Native rule, has ever held its own for a sufficient length of time to gain importance.

The unhealthiness of the climate alone, at certain periods of the year, has proved a sufficient check to European enterprise.

3. Under our Government, Kurrachee, already a considerable town, the only harbour throughout the line of coast, and possessing at the same time great natural capabilities, has been selected as the capital of the province. It is, however, nearly 100 miles from the Hajamree mouth of the Indus, and this distance has to be made, when the season permits, by the open sea, otherwise by the so-called "tidal channels," "a series of muddy creeks" running parallel, nearly, to the coast-line.

4. Kurrachee, therefore, from its situation, is not so fully benefitted by the river communication as could be desired, nor do the districts reap to the full extent the advantages derivable from the establishment of a port on the coast. The improvement of their means of intercommunication becomes, then, a matter of the greatest importance to the prosperity of the province.

The Natural Facilities offered by position.

5. A reference to the map of Scinde will show how naturally, and with what a saving of distance, a direct communication might be formed between Kurrachee and Jerruck, or Kotree, on the Indus.

The object to be considered in this Report.

6. The object to be considered in this Report may, therefore, be defined as "the substitution of a direct and effectual means of communication between the Indus and Kurrachee for the uncertain, difficult, and tedious route which the river and its tidal channels at present afford"; or, in other words, supposing Kurrachee and Kotree the two points to be connected, "reducing the distance to be traversed from 230 to 110 miles"; and further, making available for its accomplishment a more certain, speedy, and efficient method of transport than now exists.

Remarks on the Contingent Advantages of any Project decided upon.

7. It would be superfluous in me to enlarge upon the advantages derivable to the upper provinces of India by the improvement of the Indus route, which the addition of this link would effect, or upon the importance which, both in a political and commercial sense, Kurrachee, now declared a port open during the monsoon, is quickly and surely assuming,—an importance derivable chiefly from her position with regard to the markets of Central Asia and the Punjaub, aided by the facilities which its harbour, even in an unimproved state, offers to a fast and steadily increasing trade. I shall, therefore, proceed to the consideration of the subject in hand.

The means of effecting the Communication.

8. As the direct communication between the Indus and Kurrachee may be effected either by water or by a railroad, I shall consider in the first instance, the comparative advantages of the different methods which present themselves for completing the communication by water, and having selected the one offering the greatest facilities, and generally best suited to the purposes in view, I shall consider that project in detail, and eventually contrast it, as far as I may be able without detailed surveys, with a railroad.

The scheme of the Report.

The means available for completing the Communication by Water.

9. The different means of communication by water, which will at once be traced by a reference to the accompanying map, are as follows:—

1*st.*—A communication between the Indus and the Gharra Creek, by the adoption and improvement of the present bed of the Kulleeree Canal.

2*nd.*—The excavation of an entirely new line of canal from the river to the Gharra Creek.

3*rd.*—The construction of a continued line of fresh-water canal from the Indus to Kurrachee, with a direct and constant communication by means of locks, and guaranteeing to the port and town of Kurrachee an almost unlimited quantity of Indus water, which could be made applicable to the supply of the shipping, and to the purpose of general consumption.

Remarks on the same.

10. The first project was reported upon in 1840 by the late Lieutenant Colonel LeMessurier, but some errors in the details of his design rendered

his arrangements defective, and an over-estimation of the breadth of the Kulleeree Canal very much modified the deductions drawn as to the advantages of making use of its channel.

Remarks on using the Kulleeree Canal.

11. My own opinion, after considering the matter carefully, is, that in contemplating any line of water communication between the river and Kurrachee, the Kulleeree, which now answers its purpose of an irrigation canal tolerably well, should in no way be interfered with. The very process which would be necessary to improve it for the purposes of navigation, *i. e.* the conversion of its sinuosities into nearly straight lines, would, by shortening the lines of its banks, reduce the extent of its operations in a very material degree, and at the same time produce an entire revolution in the arrangements of the cultivators dependent upon its waters. Moreover, the combination in the canal of both irrigation and navigation would render an establishment for the proper conduct of the former necessary, and thus induce an expenditure not at present incurred.

On the other hand, the advantage gained by the adoption of an excavation in soft soil, bad in line, bad in level, with a tortuous course, and a width of not more than 50 feet, are very inconsiderable; particularly when, as I shall afterwards show, no permanent connection with the river near the present head of the Kulleeree could be satisfactorily effected.

12. This leads to the consideration of the second project, of an entirely new canal, connecting the river and the creek.

Remarks on the 2nd Proposition.

13. The principal objection to which this project is open is its incompleteness; for even with a canal connecting the river and the creek, the constantly navigable channel contemplated in Mr. Chief Secretary Malet's letter already quoted is far from being attained.

As far as the creek is concerned, the navigation would be in a great measure dependent upon the tides; and a canal from Wagoda would still have to be constructed, to meet the requirements of a constant communication with Kurrachee.

A further objection to this project is the melancholy necessity which its conditions impose, of allowing a large volume of fresh water, already brought upwards of 50 miles in its course, to run to waste in the salt water of the creek, the value of which, if brought to Kurrachee, could scarcely be over-estimated.

Selection of the 3rd Project for a comparison with a Railroad.

14. Upon these grounds of objection, to which the two first projects are open, I am led to recommend the adoption of the 3rd, as being complete as a means of communication, and as conferring on the rising capital of Scinde the inestimable advantage of an almost unlimited supply of good and wholesome water, the continued want of which cannot but prove a very great drawback to her future prosperity.

15. I consequently proceed to the consideration in detail of "*A Fresh-water Canal direct to Kurrachee.*"

The position of the Canal-head.

16. The first object to be attained in commencing operations last season was, necessarily, the selection of a permanent spot on the river for the construction of the works pertaining to a canal-head.

17. After a long and careful examination of the right bank of the river, which included a reconnoitering survey of 90 miles in length, I was unable to fix upon a single spot between Tatta and Jerruck which gave any promise of stability.

18. The whole river bank, until within a few miles of Jerruck, consists of a soft alluvial deposit, which offers no resistance to the wayward action of the

stream; and the extent of the changes which take place in short periods of time is almost incredible.

Tatta, for example, according to a map accompanying Colonel LeMessurier's Report, was, in 1840, only 2½ miles from the river: this distance has since increased to more than 5 miles.

The Lukka Chuch, which at that time was connected with the river, and formed the feeder of the Kulleeree Canal, is now more than a mile removed from the present bank of the Indus, and a new channel for the canal supply, 2 miles in length, has been since opened into the Indus itself.

A little higher up the river, opposite Shaik Radun on the plan, an island, 4 miles in length by 1 mile in breadth, has been formed within the last six years; the new channel cut by the river being equally navigable with that of the original course.

Eligible spot below Jerruck.

19. This rottenness of bank, and liability to constant change, manifests itself throughout, until the northern bend of the river, below Jerruck, is reached. Here the limestone hills which skirt the river from Jerruck downwards recede inland in the direction of Ponda, and a very eligible spot for a canal-head occurs; but it is, unfortunately, though from a different cause, as much liable to speedy change as the bank already passed. The reason of the want of permanency in this otherwise favourable locality is found in the existence of a deep bend in the river below Jerruck, the operation of which will be best understood from the annexed diagram.

20. The action of the stream impinging upon A is fast eating away the bank at that point, and the silt is naturally deposited on the opposite bend, between A and B. The continuation of this action must result in the gradual destruction of the apex A, C, E, and the silting up of S B, until the river works out for itself a natural and easy course in the direction A E.

So great is the opposition met with by the river on this abrupt curve, that notwithstanding the outlet afforded by the channel of the Pinaree at Bunna, and by the floods in that direction, the water during inundation at A stands 3 feet higher, with reference to the low-water marks at the respective places, than at Jerruck, and from this a judgment may be formed of the power brought into action for the gradual removal of the obstacle encountered.

Under these circumstances, in my opinion, it would not be prudent to risk the construction of the heavy works required at the canal-head, which might in a few years be rendered ineffective at this point; but rather advisable to extend the canal across the bend to Jerruck, where the reach of the river gives every promise of permanency, in the occurrence of limestone hills on either bank.

Canal-head fixed at Jerruck.

21. Immediately below the town of Jerruck, a very favourable spot exists for the construction of a canal-head, where the presence of rock at the water's edge will very much facilitate general operations.

Advantages of that locality considered.

The saving of distance effected, by cutting off the bend of the river, is no less than 6 miles, which would make a very material difference in the up-river passage; and it is to be considered as very advisable that the important works at the head of a canal should be situated close to a large town, the head quarters of a Government revenue establishment, where assistance to any extent, in case of necessity, would always be procurable.

The location of the head at Jurruck is, moreover, highly advantageous, as rendering easy the attainment of a very important object, in the facility offered for the construction of a waste-weir near Lukilatfoola, for the

purpose of returning the water into the river, and preventing the flooding of the country below, should any accident occur in the lock-gates at the height of inundation.

22. Under these circumstances, I have no hesitation in recommending Jerruck as the most fit place for the head of a canal communication with Kurrachee.

The consideration of the uses to which the Canal is to be applied, with a view to determining its dimensions.

Political application to be considered.

23. The main object of the canal is the establishment of a cheaper, more expeditious, and more certain means of transport for every description of merchandize between the port of Kurrachee and the interior, than the present imperfect river communication affords; but in most instances, and especially in this country, where seldom more than one means of communication between two points exists, and that is almost invariably constructed at the expense of Government, due regard must be paid, in framing a new design, to the political as well as commercial advantages obtainable, so that in considering the arrangements necessary for the completion of the present project, provision must be made for uniting with it a more expeditious mode of conveyance than tracking will supply, adapted to postal purposes, and the movement of troops, stores, &c.; but which might, at the same time, be made subservient to the general requirements of the travelling portion of the community.

The necessity for employing Steamers.

Their dimensions.

24. This latter object can only be effected by the introduction of steamers on the canal, well adapted, from their speed and accommodation, to the object in view, with flats, to be used, as on the Indus, when occasion requires. Small fast iron boats, somewhat similar to those employed in passenger traffic on the Thames, varying from 30 to 40 horse-power, with a length of 100, and a beam of not more than 18 feet, would best answer the purpose: they should, however, be constructed on the screw principle, with a view to saving the width due to the paddle-boxes, and diminishing at the same time the errosive action of their waves on the canal banks.

Benefit to general Public.

25. The most obvious means of ensuring the full benefit of the canal to the general traffic is to admit, without restriction, at least for the present, every description of Native craft now used in the navigation of the river, so that no drawback to its advantages may exist in the necessity of breaking bulk at the head.

The depth of the Canal.

26. As the draught of the steamers above described will always be less than that of the Native river craft, the depth of water necessary in the canal may be at once determined from a consideration of what is required by the latter.

From a return furnished me (Appendix A) by Captain Ethersey, it appears that the largest of the Native river craft is by measurement 1,400 maunds burthen, drawing when empty 2 feet, and when laden 4 feet 2 inches of water: adding, then, to the latter measurement 1 foot for contingencies, which is somewhat more than is usual in England, and again 10 inches vide Appendix G) as an allowance for the deposit of silt, and for evaporation, the depth of water required in the canal may be fixed at from 6 feet throughout. Allowing, again, 1 foot for the height of the banks above the ordinary water level, 7 feet will be the depth of excavation below the formation ground line.

The breadth of the Canal and its Locks.

27. As the breadth necessary to be given to the canal at the bottom, and the width of the locks, are to a certain extent dependent upon one another, they may with advantage be considered together.

The dimensions of the latter may be deduced from data already fixed, and those of the former may be determined from the breadth required for

the lock-gates, an allowance being made on either side for the retirement of the foot of the banks. The excess over this by the side slopes at the surface would be a sufficient provision for the contingencies of the navigation.

The beam of the largest Native vessel now used on the river varies from 19 to 21 feet: each lock-chamber would, therefore, require a width of at least 22 feet, which would be ample for the accommodation of the steamers above described. Allowing, then, 8 feet for the thickness of the central lock wall, and 3 feet on either side to clear the base of the slopes, the breadth of the canal at the bottom will stand thus:—(22+3) 2+8=58 feet: adding to this the base of the interior slopes at $1\frac{1}{2}$ to 1, or 18 feet, the total top width of the excavation for the canal becomes 79 feet, and the breadth of the water at its surface 76 feet.

The length of the Locks.

28. The length of the locks, again, is entirely dependent upon the steamers employed; and to accommodate those recommended above, including the rudder, 130 feet is the least length that can be assigned. This length, which is great, would act disadvantageously, where a necessity for economising the expenditure of water existed; but as in this case the Indus may be regarded as capable of affording an unlimited supply, the objection has little weight beyond the small increase of expenditure for lengthening the lock walls.

The Tow-path.

29. The tow-path on either side should be 12 feet broad, including a small drain on the outer, and a slightly raised edge on the inner side; the former to keep the canal free from the silt brought with the surface drainage, and the latter to give a foot-hold to the horse in tracking.

Reference to Sections* of the Canal.

30. The section of the canal as above determined will be found on reference to Plate 10.* Some of these arrangements are necessarily liable to modification, in the case of aqueducts, &c., on the score of economy; but as these considerations are connected with the engineering details, and are independent of the general description, and adaptation of the project to its requirements, they will be treated of under the proper head.

Reference to the Plan.

31. On referring to the accompanying map of the country between Kurrachee and Jerruck, the canal will be found indicated by a broad black line.

Regulation Lock at Head.

32. Immediately below Jerruck, where the canal leaves the river, the works necessary at the head, for the purpose of regulating the supply of water at all heights of the river, and for the admission and discharge of vessels, as well as buildings for the establishment, will have to be constructed. The proposed arrangements for the "Regulating Lock," being of somewhat complicated nature, are shown in detail in Plates 9 and 10.*

Course of Canal described.

33. From Jerruck the canal first crosses the plain to the south of the town, in a nearly direct line, to the opposite bend of the river, where it passes along the foot of the limestone hills which there skirt its banks, and regains the flat surface of the country some 2 miles above the village of Sonmeanee.

Dam and Escape-Weir.

At the point marked W on the plan,* a dam with flood-gates across the canal, and a waste-weir on its southern bank, will be constructed, with a view to throwing again into the river any flood-water which accident or carelessness might admit into the canal, and so to guard against injury by inundation to the country below.

34. From Sonmeanee to near the village of Lukka the canal runs parallel to the course of the river, through a country almost level, and in every way favourable to its construction.

1st Lock.

35. At Lukka advantage is taken of a narrow gorge between two limestone hills, at the termination of the low range from Hilaya, to construct a

* The detailed plans are not printed, but a map is appended of the country generally between the Indus and Kurrachee, which, for purposes of general reference, is considered sufficient.

lock, giving a fall of 8 feet, which again assimilates, as nearly as possible, the level of the canal line to the surface of the country.

Feeding the Kulleeree Canal.

36. At the same place the Kattian irrigation channel, a secondary feeder of the Kulleeree Canal, passes close on the line, and arrangements will be made here, by means of a sluice, for increasing the supply of water in the Kulleeree during the dry season to such extent as may hereafter be considered advisable.

Runn Pitteanee Aqueduct, and Lock No. 2.

37. From Lukka the canal continues its course, north of the Kulleeree, to the Runn Pitteanee River, the high-water line of which determines, thus far, the level of its bed. Having crossed this river by an aqueduct 780 feet in length, a lock with a fall of 5 feet brings the bottom of the canal to the lowest level which the high-water line of the Mullear River, the next standard, will admit of. It then proceeds through Gharra, and by embankments across the flats near Wuttogee, to Pimpree, at which place it passes through the hills, over the river by an aqueduct 1,000 feet in length, and then, following the line of the Gharra Creek, eventually emerges from its bed through the hills, a little to the north of Wagoda; whence, passing over the Mullear River channels by an aqueduct 1,750 feet in length, it takes a direct line for Kurrachee, and ultimately, having made a third descent by lock of 9 feet on passing through the rising ground, to the SE. of of cantonments, it reaches the shallow bay to the eastward of Kemaree Island, with its bottom 3 feet 6 inches above the ordinary high-water line.

Pimpree River Aqueduct.

Mullear River Aqueduct.

Lock No. 3.

General Remarks on Canal Line.

38. From its head to Pimpree, a question could hardly arise as to the line the canal should take, the ground being most favourable, and neither the cuttings (except near the head, where they must of necessity be deep,) nor embankments being on any part heavy. But a great point would have been gained could the lengthy embankment along the Gharra Creek have been avoided, by carrying the canal either through the hills by Jemedar-ke-Landi, or across into the Mullear valley, and so on through the same place to Kurrachee. The trial levels, however, taken for the purpose of judging of the feasibility of either direction, showed such heavy cuttings, and so much difficulty in the arrangements for passing the Mullear River, there on high ground, as to render both these lines economically, if not absolutely, impracticable.

The necessity of choosing the Gharra Creek Line regretted.

The Sections* referred to.

39. The levels will be fully understood by referring to the accompanying sections,* but the following general abstract will show clearly the fall of the country, and the manner in which it has been disposed of:—

The disposal of the Fall of the Country.

	Below Datum or Permanent Bench Mark, Jerruck. Ft.	In.
Assumed lowest level of the water of the Indus for canal supply (see Section*)	20	0
High-water sea level at Kurrachee, about	51	6
Fall to be disposed of	31	6
Accomplished by—		
No. 1 Lock, at Lukka, with a fall of 8 feet.		
No. 2 Lock, at Runn Pitteanee River „ 5 „		
No. 3 Lock, near Kurrachee „ 9 „	22	0
Remaining	9	6
Deduct depth of water in canal	6	0
Height of canal bottom above high-water mark, on arrival at Kurrachee	3	6

* See foot-note at page 14.

The result of the Field Works.

40. A memorandum in the Appendix marked H gives the result of the levelling operations, and shows the degree of accuracy attained under circumstances which necessitated rather hurried work.

The length of the Canal.

41. The canal from Jerruck to Kurrachee covers a distance of 92 miles 3,157 feet, and the communication with the harbour extends its length to 95 miles 1 furlong and 108 yards.

The connection of the Canal with the Harbour.

42. Having now brought the canal to its terminus at Kurrachee, the best method of effecting a communication with the harbour, by means of which the necessity of land carriage in the transfer of goods may be obviated, remains to be considered.

43. The manner in which it is proposed to attain this object is illustrated in Plate 8,* which shows the principal portion of Kurrachee Harbour.

44. The canal, as before stated, arrives at the water's edge of the shallow bay to the eastward of Kemaree, with its bottom 3 feet 6 inches above ordinary high-water level.

Canal Basin, Wharf Pier, and Dock.

Here, at the points DB in the plan,* it is proposed to construct a lock, with a fall of 9 feet 6 inches, which will drop the canal boats into an excavated basin 1,500 feet by 500, with a depth of 6 feet of water, being separated from a second dock, 1,500 feet by 300, having a depth of water at high tides of 15 feet, by a wharf pier, 40 feet in breadth; the former being for the reception of the river boats, and deriving its supply of water from the canal itself, and the latter, being adapted to the accommodation of the coasting vessels, and small craft from the harbour, and being furnished with

The proposed Cut.

salt water by a cut through the bay and Kemaree Island to the harbour, which would form at the same time the connecting link between the deep water off Kemaree Point and the canal tail.

45. The inner basin is calculated to accommodate upwards of 300 boats, of the ordinary size of river craft, and the centre pier would afford wharf room for 15 to 20 vessels at one time. The transhipment of the cargoes could be easily and economically effected by cranes, fixed at certain intervals, and working a few feet over the half breadth of the roadway.

The dimensions of the outer dock have been reduced, on account of its connection with the harbour itself.

46. The side-retaining and wharf walls of the inner basin would have to be rendered impervious to water, with a view to keeping the water in the lock chamber as sweet as possible.

47. In lowering boats into the basin, the fresh water would be passed off by sluices through the side walls of the lock, and be then available for irrigation and ordinary purposes.

48. Drinking water would be drawn from the canal above lock No. 3, and could from that point be laid on to most houses in cantonments, or to reservoirs in the town; but it would require to be raised a few feet for the supply of the new barrack, hospitals, and the upper stories of dwelling houses.

49. The water for the use of the shipping would be carried from above lock No. 3 by pipe, along the embankment of the bay cut, to Kemaree and the harbour.

The recovery of the Land covered by the Bay by degrees, without further material expenditure.

N.B.—As the proposed cut passes through the Chinee Creek, and then along the deep water channel, which, before the construction of the mole, formed the tide-way of the greater part of the bay, it might be made available, in conjunction with the long contemplated bund across

* See foot-note at page 14.

the mouth of the creek, for the drainage, and ultimate recovery, of the whole of the bay from the sea.

The cut being completed to a depth of 15 feet, with an embankment on either side, the whole of the water might be gradually withdrawn, through sluices left for the purpose in its banks.

By drawing off, and allowing the next tide to renew the *whole* of the water occasionally, stagnation would be prevented; and by decreasing, *by degrees,* the quantity allowed to pass in at certain intervals, *small surfaces only of mud round the edge of the bay* need be subjected to the process of evaporation *at one time,* and the bad effect which the sudden exposure of a large extent of slimy soil to the action of the sun might be supposed to to have on the salubrity of the neighbourhood, would be in a great measure, if not entirely avoided.

Canal Estimate; General Remarks.

50. As, during the progress of the inquiry into the canal project, that of a railway has been so prominently brought forward, I have thought it advisable not to enter so minutely into the details of the canal (the drawing out of elaborate plans and estimates for aqueducts, for example,) as would necessitate an extensive establishment, and at the same time cause great delay in the completion of the report; but I have endeavoured rather to lay the project as soon as possible before Government, wanting in no essential which would materially affect the scheme in comparing it with a rail-road, still involving no work which would be useless for the same purpose; and thus to afford means of arriving at a conclusion as to the comparative advantages of the two proposals, without any great preliminary expenses on either.

Sections.

51. Keeping this intention in view, the sections, which were taken with great care, have also been carefully calculated, and cut-stone bench marks have been established at the points shown on the plan, which will be available for reference at any stage of the work.

Aqueducts.

52. The aqueducts, instead of drawing a detailed plan for each, have been roughly estimated, taking the Solami aqueduct on the Ganges Canal as a general guide, and making the necessary allowances for the difference in dimensions, cost of labour, &c.

Watercourses.

53. The watercourses have been classified by the areas of their high-water sections, and then arranged under three different heads, (showing the manner in which they will be disposed of,) according to their situations with regard to the canal bed. The classification of the watercourses will be found on reference to Appendix to Estimates E and F.

Rough Plans not forwarded.

54. Of these arrangements, as well as for the small locks, the basin, dock, &c., I have rough plans drawn out, from which they have been estimated; but as they involve neither complicateness nor difficulty in their details, it does not appear necessary to submit them in form.

The Regulation Lock at Head.

55. The regulation lock at the head, being an important work, and complicated in its arrangements, from having to provide for a rise and fall, and to withstand a head of water 20 feet in height, requires to be drawn in detail. It is shown in Plates 9 and 10.

The object of the double Lock-gates.

56. The object of the double set of lock-gates is to ensure the large gates being in a state of efficiency whenever the river may rise, whilst the smaller gates will be available at all times, except during the inundation, and can of course be worked with much greater ease than the large ones.

The Cut.

57. The cut to the harbour will be a work of considerable labour and difficulty; but, as the project would not be complete without it, and it will

very greatly enhance the value of the communication, I would strongly recommend its adoption.

58. The bed of the bay immediately below the water is composed chiefly of a heavy blue clay, well adapted for the necessary embankments. I propose to line the cut with teak-wood piles 20 feet apart, connected with waling pieces above, and driven into the bed to correspond with the slopes of its sides, and to strengthen the intervals to a depth of 12 feet (or the difference between high and low spring tides) with a strong dry rubble pavement: this will be a very durable style of work, and will, I have no doubt, be found efficient.

The Dam and Escape-weir at Lukilatfoola.

Bridges.

59. In addition to the four small locks already described, and shown to be necessary to allow for the fall of the country, a *dam* and escape-weir at Lukilatfoola, and six road-bridges are required. Specifications of these, as well as of the necessary buildings, will be found at the head of their respective estimates. (Vide Estimate.)

Reference to Estimate.

Cost of Project.

60. From the general abstract of the accompanying estimate it will be seen that the estimated cost of the canal from Jerruck to Kurrachee is Rs. 44,86,597, whilst that of the cut forming the communication with the harbour amounts to Rs. 3,64,175.

The total expenditure for the complete project is, therefore, Rupees forty-eight lakhs, fifty thousand, seven hundred and seventy-three.

Consideration of probable Returns.

61. The next subject to be considered is the amount of traffic that may be expected on the canal, from which to deduce the means of ensuring some return on the outlay; and here it will be necessary to examine carefully the advantages which the project offers to the public, in order that the success of the scheme may not be hazarded by a too high taxation.

The number of Boats and amount of Traffic that may be expected on the Canal.

62. To enable a judgment to be formed as to the number of vessels likely to pass through the canal in the course of the year, a very satisfactory return of the river traffic for the year 1852-53 (vide Appendix B) is available. An abstract from this, given below, shows the number of boats which passed the following places on the river, during the course of the last year:—

Size of Vessels.	Sehwan.		Tatta Bunder.		Kotree.		Ghorabarree, Kettie, Unnie, and Wagoda.	
	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.
Above 1000 maunds	20	5	155	64	248	157	102	45
From 800 to 1000 maunds	31	6	144	43	286	201	175	70
„ 600 to 800 „	82	39	581	169	787	504	586	229
„ 400 to 600 „	200	92	1,020	277	1,477	743	1,132	453
„ 200 to 400 „	559	278	970	328	1,512	848	965	455
Under 200 maunds	876	370	388	1,720	1,746	2,662	1,166	727
Totals.....	1,768	790	3,258	2,601	6,065	5,115	4,126	1,979
	2,558		5,859		11,180		6,105	

63. From this statement, an approximation to the number of vessels which made the passage *through* to the ports at the different mouths of the river, and which may therefore be supposed to pass *through* the canal, may be readily deduced.

The Return at Kotreenot reliable.

64. The largest number of vessels passing down the river is shown at Kotree; but from this return being nearly double that registered at Tatta, it is clear, either that "a very large number of vessels from up-river discharged

their cargoes at Hydrabad;" "that there are places between Kotree and Tatta capable of consuming as much as half the traffic supply;" or "that an extensive local traffic is taken into account in the returns." The first of these suppositions is not borne out by the comparatively small return at Sehwau; Jerruck, the only town of any importance between Hydrabad and Tatta, cannot be made to account for the consumption implied in the second: the third supposition must, consequently, in a great measure hold good; so that the return for Kotree cannot be taken to represent the canal traffic.

Reason for adopting the Tatta Return.

65. The traffic registered at Tatta Bunder, on the other hand, or 5,859 vessels, laden and unladen, may be fairly taken as an approximation to that on a canal, because the number of vessels passing that point, and the total of those registered at the delta branches at the river, *i. e.* at the bunders of Ghorabarree, Kettie, Unnie, and Wagoda, nearly agree, proving that there is very little addition to the river traffic below Tatta. The slight increase in the total of the register of the latter places may fairly be allowed for the local movements of small craft, which may be assumed to be considerable, from the great proportion of vessels under 200 maunds shown in their returns.

Tolls to be levied.

66. Though not generally an advocate for the imposition of a tax, on a line of road for example, when the improvement of the communication is sure to repay the outlay by indirect advantages to the State, still I think a tax can be fairly shown to be admissible in this case, where a very large expenditure is involved, the advantages, in point of time and distance, are so much greater than can usually be looked for, and an establishment, moreover, for the efficient working of the scheme, must of necessity be kept up.

Tolls how levied.

67. This tax may be drawn from two sources—1*st*, from fees to be payable at each lock; and 2*nd*, from wharfage and carriage fees to be levied at the basin, or other points where the cargo may be discharged.

The amount of 1st Toll.

68. In order to form a judgment of the amount of the first tax recommended, the advantages offered to the public by the scheme must be considered.

69. By referring to the accompanying Return (Appendix A) prepared by Captain Ethersey, it will be seen that the trip from Sukkur to Ghizree Bunder and back by the river occupies on an average 70 days, while that from Sukkur to Hydrabad is usually performed in 42 days. The difference of these periods gives from Kotree to Ghizree Bunder 28 days; and allowing the proportion of time from Kotree to Jerruck at 4 days, 24 days may be taken as the average time of passage from Jerruck to Ghizree Bunder.

70. On the other hand, the length of the canal being 92 miles, and supposing the crew of a boat (concluding that it will be some time before the economy of horse-power will be appreciated) to track 8 hours per diem, at the rate of 2 miles an hour, their progress during the day would be 16 miles, and 12 days would consequently be ample allowance for the transit of the canal to and fro.

71. This gives a clear gain in time of 12 days each trip. Leaving this substantial advantage, as well as the decrease of wear and tear and risk (which latter, I understand from Mr. Amos, the Government Steam Agent, is estimated at 7 per cent.) entirely to the boatmen, as an inducement to exertion and enterprise, it appears to me that a tax may be fairly levied on each boat, equal to the *saving* effected in the *subsistence* of the crew *during the time gained.*

72. Applying this to the medium-sized boat of Captain Ethersey's return, of 700 maunds, and having a crew of ten men, 120 days' provisions for one man is the saving which results: taking each day at one anna, one-third the rate of wages allowed by Captain Ethersey, and Rs. 7½ represents the tax to be levied on each boat, which would be distributed, in proportion to the distance, at the different locks.

The Revenue derivable.

The annual income derivable from this source, calculated for the number of boats which it is concluded will pass through the canal, or 5,859, is Rs. 43,942; and this will no doubt rapidly increase.

The 2nd Toll; continued Craneage.

73. The second tax recommended, which will fall exclusively on the merchants or shippers, is that to be levied on the use of the wharf and cranes at the basin, and may be approximately determined by the following considerations:—

74. The former calculations suppose Ghizree Bunder to be the point of discharge of cargo. If not discharged there, all freight destined for Kurrachee is sometimes transferred into sea boats, and sometimes brought at once by the river craft through one of the mouths of the Indus into the harbour.

Rate of 2nd Toll.

75. In the first case an extra expenditure for land carriage, at the rate of Rs. 1 per 12 maunds is incurred, and the freight from Ghorabarree or Khettie to Kurrachee may be estimated at Rs. 2-8-0 per 100 maunds; so that were Rs. 2 charged for the use of the cranes and wharfage room at the basin, on every 100 maunds of cargo transhipped, the public would still profit by the new arrangement, and 1,546,600 maunds, the maundage of the laden boats in the Tatta return (Appendix B) would give a further income of Rs. 30,932.

Revenue of 2nd Toll.

76. The amount of direct revenue derivable from the project being thus determined, the following Statement will show its merits as a commercial speculation:—

	Rs.	a.	p.
Total amount of estimate	48,52,773	0	0
Probable cost of two small steamers, of the dimensions and power proposed	1,60,000	0	0
Ditto two flats or barges	10,000	0	0
Total capital required	50,22,773	0	0
Interest at 3 per cent. on above	1,50,683	0	0
Cost of Maintenance.			
Yearly establishment	6,252	0	0
Yearly repairs, at Rs. 250 per mile, for 96 miles	24,000	0	0
Cost of working two small steamers one trip each way per diem, or 92½ miles, about Rs. 50 per diem for each vessel	36,500	0	0
Wear and tear of vessels, at 4 per cent. on prime cost.	6,800	0	0
Total cost of maintenance	73,552	0	0
Probable Returns.			
By receipt from lock tolls, 5,859 boats, at Rs. 7½ each.	43,942	8	0
By wharfage and craneage fees on 1,546,600 maunds, at Rs. 2 per 100 maunds	30,932	0	0
Yearly expenses of two steamers to be dispensed with from the Indus, vide Captain Ethersey's letter (Appendix A to Railroad Report)	75,000	0	0
Carried forward....Rs.	1,49,874	8	0

Brought forward ....Rs.	1,49,874	8	0
Yearly cost of post, vide Postmaster's letter No. 482, (Appendix to Railroad,) three-fourths of Rs. 24,000 (to Jerruck). The steamers can readily be worked at the rate of 10 to 12 miles an hour	18,000	0	0
422 tons of private merchandize conveyed by the Indus Flotilla (vide Appendix to Railroad,) at 1 anna per ton per mile on 92.5 miles	2,439	11	0
[Government stores and troops by river are included in the Rs. 75,000 allowed for the Indus Flotilla expenses.]			
2681 tons of traffic overland, according to the returns given in Appendix F and G to Railroad, at 1 anna per ton per mile.....	15,499	8	6
Total....Rs.	1,85,813	11	6
Deduct Cost of Maintenance	73.552	0	0
Direct return (more than 2 per cent. on the outlay)....	1,12,261	0	0

Direct Return yielded by the Canal.

77. The canal would, therefore, yield in direct returns about 2 per cent. on the gross outlay, making no allowance for the certain increase of traffic, or for the receipts by passengers and parcels, which latter items would probably prove a source of considerable revenue.

Indirect Return.

78. In addition to the direct returns, however, the contingent advantages, alluded to above, which the unlimited supply of Indus water is calculated to secure, have yet to be examined, in considering the project as a remunerative speculation.

The Water supply.

79. The supply of water required may be classed under three heads: 1*st*, the supply to the harbour and shipping; 2*nd*, the supply to the town of Kurrachee; and 3*rd*, the supply to the cantonment.

Its desirability.

80. The advisability of adopting and carrying out some scheme for securing to the inhabitants of the town, as well as to the harbour of Kurrachee, an abundant supply of good and wholesome water, has been so well considered, and so clearly and strongly advocated by the Board of Conservancy, that I cannot better exemplify the urgency of the want, than by an extract of a memorandum by one of its oldest and most active members, the present Collector of Customs. He says: "Hitherto, the water within moderate reach has been at all times indifferent, and occasionally scarce. The Scindees have not complained, for they have never known it otherwise: to all, however, who have made Kurrachee their residence since British occupation, the saltness of the water has been a source of inconvenience, and they have been obliged to draw their supplies from a distance, the expense attending which I have ascertained to range from Rs. 2 to Rs 4 for each house monthly. The harbour, and the residents at Kemaree and Baba, get their supplies at the bunder, at the cost of 2 annas the puckal, and the article is of the worst kind, being dirty brackish water. To this part of the population, now considerable, and fast increasing, the aqueduct will be of the utmost service."

Advocated by the Board of Conservancy.

The calculation of the Board as to the Amount of Supply required adopted.

81. As the Sub-Committee of the Board entered at length into the supply required by the harbour and town of Kurrachee, during the end of 1851, when an estimate for an aqueduct to lead from wells sunk in the valley of the Learee was prepared, I shall adopt their calculations on these points, allowing the increase of the shipping visiting the harbour, and of

the population of the town during the period which has intervened, to compensate for any over-estimation which may at that time have occurred.

82. The supply of water in the canal cannot fail to be abundant, and a good head is at once available immediately above lock No. 3, where the surface of the water stands 18 feet 5 inches above the high-water mark of the sea: a height quite sufficient to command the town, harbour, and cantonments, as well as the basement floors of all the new barrack buildings, with the exception, perhaps, of the hospitals.

83. On a rough estimate, the expense attendant upon the distribution of the water is as follows:—

	Rs.	*a.*	*p.*
10,500 running feet of 4-inch main pipe from head to junction of town pipe, at Rs. 1½ per foot, including laying, and all expenses	15,750	0	0
16,817 running feet of 3-inch pipe from lock No. 3 to harbour at Kemaree, along the cut embankment.			
10,560 running feet of 3-inch pipe from junction, through Sudder Bazar by Golundauze lines, to town reservoir.			
5,500 running feet of 3-inch pipe from junction of town pipe and main pipe, through Commissariat Store and Native Infantry lines.			
32,877 running feet of 3-inch iron piping, including laying, &c., at Rs. 1¼ per foot	41,096	8	0
5,280 running feet of service pipe, at Rs. 1 per foot, for supply of Government House, &c..... ...	5,280	0	0
Reservoirs, &c.....	5,000	8	0
Total amount .... Rs.	67,127	0	0

The returns, on the other hand, making use of the calculations approved of by the Board, would be as below:—

Returns from the Supply of the Town and Harbour.

	Rs.	*a.*	*p.*
An average of 14,400 gallons supplied daily to the harbour and shipping, at 1 anna for 25 gallons (or half the price at which bad brackish water is now procurable)	13,140	0	0
An average of 62,600 gallons to the townspeople, at 1 anna per 100 gallons; or to be recoverable by a house tax, if considered preferable	14,280	9	0
Saving effected in the annual charge to Government for the supply of water to the Government establishment and vessels in the harbour, estimated by the Board from Rs. 9,000 to Rs. 15,000, say.....	12,000	0	0
Supply to Camp.			
The annual saving effected by supplying the Camp at all points, instead of, as now, having to convey water, especially to the new barracks, a considerable distance (vide "Abstract Statement of Cost of supplying Water to Corps and Establishments," Appendix C).....	10,500	0	0
Total amount of Revenue from water supply .....Rs.	49,920	9	0

84. Deducting from this amount interest at the rate of 5 per cent. on the sum expended, or Rs. 3,357, we have a clear yearly return on account of the water supply of Rs. 46,563, which, added to the profits of the canal proper, gives Rs. 1,58,824, or more than 3 per cent. upon the entire outlay.

85. It must, however, be borne in mind, in considering the merits of the project, that several sources of advantage to the State and revenue have not been taken into account in the above calculations. These may be enumerated, as follows :—

1*st.*—The movement of troops by land, which, with carriage, and wear and tear of kit, cannot but prove a heavy item of expenditure.

2*nd.*—The local charges of the Commisariat Department, in merely moving Government stores in the immediate neighbourhood. The expense incurred on this item alone will be found by a return (marked D in the Appendix) to amount to Rs. 12,856 per annum, the greater part of which would be rendered unnecessary by the arrangements proposed at the basin, in the present project, and by the connection of the canal with the harbour.

3*rd.*—The further revenue derivable from the increased supply of water to the Kulleeree canal.

4*th.*—The application of the water at and in the neighbourhood of Kurrachee to the purposes of irrigation.

5*th.*—The return derivable from the supply of water to the houses in cantonments, as well as to those in the camp bazar, the population of which was given in the last returns at 16,900 souls.

86. Taking into consideration these further contingent advantages, which have only been omitted in the examination of the project from the difficulty of determining the revenue to be allowed for each, it appears probable that 4 per cent. upon the entire outlay, or even more, might be expected from a canal, under skilful and judicious management.

For continuation see accompanying Railroad Report.

W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

Kurrachee, November 1*st*, 1853.

APPENDIX A.

Statement exhibiting the General Tonnage and Draught of the Native Craft employed in the River Traffic, together with a Scale showing the Government Mode and Rate of Hiring the same by the Trip, and the usual Time allowed for the up and down Voyage.

Size in Maunds.	Crew allowed.		Pay of Crew per Month.			Amount of Tonnage, at Rs. 2 per 100 Maunds.			Total Pay per Month.			Draught when Empty.		Draught when Laden.		Time allowed when Boats are taken up by the Trip, which includes the Return Voyage.	Remarks.
Native Boats.	Tindal.	Lascars	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Ft.	In.	Ft.	In.		
100	1	2	16	0	0	2	0	0	18	0	0	1	0	2	0		
150	1	4	26	0	0	2	0	0	29	0	0	1	1	2	2		
200	1	4	26	0	0	4	0	0	30	0	0	1	2	2	4	From Sukkur to Larkhana..... 8 days	Boats hired by the trip are paid for the number of days allowed at the monthly rate, which always includes the return trip, whether it be up or down.
250	1	5	31	0	0	5	0	0	36	0	0	1	3	2	6	„ „ Sehwan ..... 20 „	
300	1	5	31	0	0	6	0	0	37	0	0	1	4	2	8	„ „ Hydrabad ..... 42 „	
350	1	6	36	0	0	7	0	0	43	0	0	1	5	2	10	„ „ Tatta ..... 50 „	The same number of days are allowed throughout the year between the different places.
400	1	6	36	0	0	8	0	0	44	0	0	1	6	3	0	„ „ Beacan ..... 60 „	
450	1	7	41	0	0	9	0	0	50	0	0	1	7	3	2	„ „ Ghizree Bunder. 70 „	When boats are towed by steamers, payment is made for the number of days actually employed, at the rates set forth.
500	1	7	41	0	0	10	0	0	51	0	0	1	8	3	4	„ „ Shikarpore .... 10 „	
550	1	8	46	0	0	11	0	0	57	0	0	1	9	3	6	„ „ Mittencote .... 25 „	
600	1	8	46	0	0	12	0	0	58	0	0	1	10	3	8	„ „ Bukree ..... 35 „	Merchants have a different method of hiring boats; but there is no fixed rate, the charges being more or less, as tonnage at the time may be scarce or abundant.
650	1	8	46	0	0	13	0	0	59	0	0	2	0	3	10	„ „ Mooltan ..... 46 „	
700	1	9	51	0	0	14	0	0	65	0	0	2	0	4	0	„ „ Bhawulpore.... 42 „	
750	1	9	51	0	0	15	0	0	66	0	0	2	0	4	0	„ „ Ferozepore .... 84 „	In the case of grain, it is conveyed at so much per kurwah; and, in addition to the rate agreed upon, the owner of the grain supplies the crew of the boat, at the rate of one seer per day to each man, while it is on board.
800	1	10	56	0	0	16	0	0	72	0	0	2	0	4	0	„ „ Dhera Ishmael Khan ..... 64 „	
850	1	10	56	0	0	17	0	0	73	0	0	2	0	4	0		
900	1	11	61	0	0	18	0	0	79	0	0	2	0	4	0	„ „ Dhera Ghazee Khan ..... 43 „	
950	1	11	61	0	0	19	0	0	80	0	0	2	0	4	0		
1000	1	11	61	0	0	20	0	0	81	0	0	2	0	4	0	„ „ Leia..... 53 „	From Hydrabad to Khettie, the rates vary at different times of the year from 8 annas to Rs. 1-4-0 per kurwah. The same of other places.
1100	1	12	66	0	0	22	0	0	88	0	0	2	0	4	0	„ Mooltan to Dhera Ishmael Khan ..... 60 „	
1200	1	12	66	0	0	24	0	0	90	0	0	2	0	4	0		
1300	1	13	71	0	0	26	0	0	97	0	0	2	0	4	0		
1400	1	14	76	0	0	28	0	0	104	0	0	2	0	4	2		

(True copy)

W. CHAPMAN, Lieutenant,
Engineers.

(Signed) R. ETHERSEY, Captain, I. N.,
Commanding Indus Flotilla.

Kotree, 20th June 1853.

APPENDIX B.

Return showing the Number of Boats arriving at and departing from the undermentioned Bunders on the Indus, during the Years 1851–52 *and* 1852–53.

Ports.		Steamer with Flat.		Steamer without Flat.		Size of Boats.												Total Tonnage.		Laden.		Unladen.	
						Above 100 Maunds.		From 800 to 1000 Maunds.		From 800 to 600 Maunds.		From 400 to 600 Maunds.		From 200 to 400 Maunds.		Less than 200 Maunds.							
		Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Laden.	Unladen.	Increase.	Decrease.	Increase.	Decrease.
River Ports.																		Maunds.	Maunds.	Maunds.	Maunds.	Maunds.	Maunds.
Sukkur	1851-52	13	..	27	10	12	19	45	41	190	183	452	308	401	328	909	315	6,23,900	4,69,800	....	....	....	....
	1852-53	18	1	33	4	41	11	88	39	280	136	588	357	405	274	810	214	8,16,800	4,25,500	1,92,900	....	....	44,300
Sehwan	1851-52	10	1	47	19	109	93	241	232	532	376	705	887	723	503	833	1,489	13,61,900	13,67,600	....	....	....	....
	1852-53	20	5	31	6	82	39	200	92	559	278	876	370	707	377	927	1,628	14,04,300	7,81,200	42,400	....	....	5,86,400
Kotree and Gidooka-Tanda, the port of Hydrabad	1851-52	37	9	119	42	198	151	222	179	645	366	1,231	612	1,473	679	1,027	2,111	20,29,200	13,03,200	....	....	....	....
	1852-53	80	22	90	66	248	157	286	201	787	504	1,477	743	1,512	848	1,476	2,662	24,05,800	15,98,500	3,76,600	....	2,95,300	....
Tatta	1851-52	13	3	58	28	116	60	108	51	435	190	570	323	912	419	518	1,819	11,39,700	7,14,900	....	....	....	....
	1852-53	23	..	69	13	155	64	144	43	581	169	1,020	277	970	328	388	1,720	15,46,600	6,37,100	4,06,900	....	....	77,800
Delta Ports.																							
Gorabarree and Khettie, on the Dochta	1851-52	..	..	..	..	88	50	110	67	349	163	720	369	833	583	658	638	11,15,800	6,52,600	....	....	....	....
	1852-53	..	..	11	..	85	36	144	43	508	163	1,019	357	872	390	1,156	584	14,65,400	5,45,300	3,49,600	....	....	1,07,300
Wagoodur, on the Gharra Creek	1851-52	7	..	43	1	25	12	14	16	42	36	79	43	47	34	7	19	1,23,800	86,400	....	....	....	....
	1852-53	10	..	41	..	17	9	31	27	78	66	113	96	93	65	10	143	1,86,600	1,62,200	62,800	....	75,800	....
Unnie, on the Kedewaree Branch	1851-52	14	2	44	7	1	..	..	..	7	1	21	1	12	1	2	27	20,300	4,200	....	....	....	....
	1852-53	18	..	68	..	..	..	..	..	..	..	..	..	..	..	1	4	100	400	....	20,200	....	3,800
1851-52....		..	..	..	..	549	385	748	586	2,200	1,315	3,778	2,543	4,401	2,547	3,954	6,905	64,14,600	45,97,800	....	....	....	....
1852-53....		..	..	..	..	628	316	893	445	2,793	1,316	5,063	2,200	4,559	2,282	4,768	6,963	78,25,600	41,50,200	14,31,200	20,200	3,71,100	8,19,600

(True copy)
W. CHAPMAN, Lieutenant,
Engineers.

(True copy)
(Signed) H. B. ELLIS,
Assistant Commissioner.

APPENDIX C.

Abstract of Returns received from Officers Commanding Corps, and Heads of Departments at Kurrachee, showing the Expense at present incurred by Government in supplying Water for their use, as well as the estimated probable Saving to Government were Water fully supplied at all points by a Canal.

Corps and Departments.	Puckals.	Bheesties.	Carts.	Monthly Expense. Rs.	a.	p.	Proportion estimated as Saving. Rs.	a.	p.	Remarks.
Lieutenant Colonel Law, commanding H. M.'s 83rd Regiment	..	12	12	120	0	0	60	0	0	Water to Regimental Lines supplied by Commissariat Department.
Lieutenant Colonel Stopford, commanding H. M.'s 64th Regiment	..	27	27	270	0	0	135	0	0	Barracks supplied by Commissariat Carts.
Captain Forster, commanding 1st Troop H. A.	4	4	..	96	0	0	48	0	0	
Lieutenant Sellon, commanding Sappers and Miners	3	..	..	27	0	0	13	8	0	
Major Morse, commanding 8th Regiment N. I.	..	..	..	.....			.....			Supplied by Commissariat.
Major Stewart, commanding 14th Regiment N. I.	..	..	..	.....			.....			Ditto ditto.
Lieutenant Lucas, in charge No. 9 Light Field Battery	1	..	..	9	0	0	.....			Assisted by Commissariat.
Executive Engineer on various counts	..	..	..	592	0	0	296	0	0	
General Hospital	2	..	..	18	0	0	.....			
Commissariat Department Public Carriage employed in supplying Water to Troops and Departments in Cantonments	8	8	62	578	0	0	289	0	0	
Commissioner's Establishment	3	1	2	59	0	0	29	8	0	
Collector's Establishment	..	6	..	6	0	0	.....			
Deputy Collector of Customs' Establishment	..	1	..	5	0	0	.....			
Church Establishment	..	..	..	10	0	0	4	0	0	
Ordnance Department, no return received	..	..	..	.....			.....			
Saving in Monthly Expenditure							875	0	0	Representing a Capital at 5 per cent. of Rs. 2,10,000.
Saving in Yearly Expenditure							10,500	0	0	

(True extract of Returns)

W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, October 1853.

APPENDIX D.

Abstract of Returns of Carts employed by the Commissariat Department, Kurrachee, in the conveyance of Public Stores, &c. to and from the undermentioned Places, during the Official Year 1852–53.

Year.	From Commissariat Stores to Kurrachee Bunder and Kemaree.		From Kemaree and Kurrachee Bunder to Commissariat Stores.		From Commissariat Stores to Ghizree Bunder.		From Ghizree Bunder to Commissariat Stores.		From Wagoda to Commissariat Stores.		From Commissariat Stores to Wagoda.	
	No.	Loads, lbs.	No.	Loads, lbs.	No.	Loads, lbs.	No.	Loads, lbs.	No.	Loads, lbs.	No.	Loads, lbs.
1852–53 ..	11,960	600 to 800	2,823	600 to 800	1,042	600 to 800	682	600 to 800	9	600 to 800	9	600 to 800

(True extract from Returns)
W. CHAPMAN, Lieutenant,
Engineers.

(Signed) C. BIRDWOOD, Major,
Assistant Commissary General.

Kurrachee, Commissariat Office, 1st October 1853.

Abstract Estimate of Cost.

	Rs.	A.	P.	
14,783 Carts, columns 1 & 2, at 12 annas each	11,087	4	0	These sums do not of course include the loading and unloading, which may be supposed to be still required at the wharf.
1,724 „ „ 3 & 4, at Rs. 1 each.....	1,724	0	0	
18 „ „ 5 & 6, at Rs. 2-8-0 each	45	0	0	
Total Annual Cost to Government....	12,856	4	0	

W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, October 1853.

APPENDIX E.

Names and Dimensions of Rivers and Watercourses crossed by a line of Levels from Jerruck to Kurrachee.

Nos.	Names.	Breadth.	Depth.	Stations.		Distances.
		Feet.	Feet.			
1	Baglee Wah	6	5	2nd Pin of ⊙	12	3rd mile.
2	Chundun Wah	10	9	3rd „ „	23	4th „
3	Larka Wah (old)	14	10	„ „ „	9	
4	Watercourses	6	3	2nd „ „	13	8th „
5	Larka Wah (new)	7	8	„ „ „	14	
6	Sakka Wah	5	10	„ „ „	22	
7	Jam Wah	10	16	„ „ „	24	10th „
8	Gharee Wah	10	16	„ „ „	26	
9	Hajee Wah	14	11	„ „ „	28	11th „
10	Alibahar Wah	16	12	„ „ „	45	14th „
11	Gidder Wah	16	8	„ „ „	60	16th „
12	Gharree Wah	15	8	„ „ „	64	17th „
13	Shahat Wah	14	6	„ „ „	73	19th „
14	Watercourse Irrigation	10	4	190 past 2nd Pin ⊙	224	
15	„	3	1½	262 „ „ „ „	223	25th „
16	„	4	0½	36 „ „ „ „	223	
17	„	4	1	2nd Pin of ⊙	222	
18	„	6	1	428 past 2nd Pin ⊙	219	
19	„	3½	1⅓	262 „ 1st „ „	218	
20	„	9	4¾	336 „ 2nd „ „	217	26th „
21	„	4	1½	90 „ „ „ „	216	
22	„	4	1⅓	210 „ „ „ „	214	
23	„	7	4	62 „ „ „ „	214	
24	„	4	6	256 „ „ „ „	213	
25	„	7	3	153 „ „ „ „	207	27th „
26	„	6	2½	27 „ 1st „ „	207	
27	„	9	3	8 „ „ „ „	205	
28	„	4	1	228 „ 2nd „ „	203	
29	„	4	1	313 „ „ „ „	202	
30	„	15	3	75 „ 1st „ „	201	
31	„	4	2	120 „ 2nd „ „	201	28th „
32	„	7	2	337 „ 1st „ „	201	
33	„	7	2	14 „ „ „ „	201	
34	„	5	2	234 „ 2nd „ „	199	
35	„	7	2	343 „ „ „ „	198	
36	„	9	4	42 „ „ „ „	197	
37	„	10	6	120 „ „ „ „	197	
38	„	5	1⅓	88 „ „ „ „	196	29th „
39	„	4	6	157 „ 1st „ „	195	
40	„	5	6	296 „ „ „ „	192	
41	„	11	4	14 „ 2nd „ „	191	
42	„	9	3	100 „ „ „ „	189	
43	„	6	1	66 „ 1st „ „	189	
44	„	5	1	250 „ „ „ „	188	
45	„	6	3	236 „ 2nd „ „	186	
46	„	7	3	116 „ „ „ „	186	30th „
47	„	10	3	84 „ „ „ „	185	
48	„	5	2	6 „ 1st „ „	185	
49	„	5	1½	214 „ „ „ „	184	
50	„	8	1	197 „ 2nd „ „	183	
51	„	5	1	200 „ „ „ „	182	
52	„	7	2	205 „ 1st „ „	182	
53	„	7	2	43 „ „ „ „	182	
54	„	4	9	196 „ 2nd „ „	181	
55	„	5	1	310 „ 1st „ „	181	31st „
56	„	5	1½	217 „ „ „ „	181	
57	„	10	2	200 „ „ „ „	181	
58	„	6	3	84 „ 2nd „ „	180	
59	„	4	2	305 „ 1st „ „	180	
60	„	3	0½	255 „ 2nd „ „	179	

Nos.	Names.	Breadth.	Depth.	Stations.			Distances.
		Feet.	Feet.				
61	Watercourse Irrigation	5	2	14 past 2nd Pin ⊙		179	
62	„	38	4	111 „ 1st „	„	177	31st mile.
63	„	9	3	22 „ „ „	„	177	
64	„	26	3	286 „ 2nd „	„	176	
65	„	3	1½	323 „ „ „	„	174	
66	„	7	3	277 „ „ „	„	174	
67	„	4	1	299 „ „ „	„	172	32nd „
68	„	14	2	147 „ 1st „	„	172	
69	„	15	3½	222 „ 2nd „	„	171	
70	„	7	1	52 „ „ „	„	160	
71	„	4	6	300 „ 1st „	„	160	
72	„	12	3	206 „ „ „	„	159	33rd „
73	„	5	2¾	205 „ „ „	„	155	
74	„	7	3½	51 „ „ „	„	154	
75	Channel of Kulleeree.....	9	6	3 „ „ „	„	147	35th „
76	„	13	4	40 „ „ „	„	136	37th „
77	Watercourse Dund	7	2	63 „ 2nd „	„	115	39th „
78	„	11	2	216 „ 1st „	„	115	
79	Channel from Kulleeree	15	5	207 „ 2nd „	„	109	40th „
80	„	15	6	11 „ „ „	„	109	
81	„	16	5	20 „ „ „	„	108	
82	„	14	3	96 „ 1st „	„	107	41st „
83	Watercourse Dund	9	3	16 „ „ „	„	106	
84	„	3	0½	182 „ 2nd „	„	96	
85	„	10	0¾	3rd Pin	„	95	42nd „
86	Channel.....	50	2	285 past 1st Pin ⊙		95	
87	„	69	2	56 „ 2nd „	„	90	43rd „
88	„	60	2	130 „ 1st „	„	48	48th „
89	Runn Pitteanee River	550	6½	96 „ 2nd „	„	46	49th „
	On Pin..	780					
90	Chaimel Creek	12	3	110 past 2nd Pin	„	29	51st „
91	„	8	2	110 „ 1st „	„	21	52nd „
92	„	25	2	40 „ „ „	„	14	
93	„	27	5	59 „ „ „	„	13	53rd „
94	Perpunnon Wah	8	2	15 „ „ „	„	10	
95	Nullah (saltwater)	200	7½	3rd Pin of ⊙		8	56th „
96	„ „	70	7	„ „ „		23	59th „
97	„ „	110	3½	„ „ „		47	62nd „
98	Guggen River, n. Wuttagee.....	1000	..	„ „ „		1	64th „
99	Nullah (salt).....	80	5	„ „ „		16	67th „
100	Jurrund Nullah.....	12	10	„ „ „		25	69th „
101	Peepul River.....	1000	17½	„ „ „		3	
102	Nullah	20	4	„ „ „		23	73rd „
103	Lutt River.....	75	4	„ „ „		45	76th „
104	Raree River	100	4	„ „ „		62	79th „
105	Nullah	102	13	„ „ „		84	82nd „
106	„	200	2	100 past 2nd Pin ⊙		112	87th „
107	Mullear (portion)	350	5	2nd Pin of ⊙		117	
108	„ (main branch).....	950	9	3rd „ „ Pin 119 opposite Bank.		118	88th „
109	„ (portion).....	450	8	50 past 3rd Pin		122	89th „

APPENDIX F.

Arrangement for the disposal of Watercourses, with a deduction of Mean Depths, and Area of Opening required.

Size of Watercourses.	To be taken under the Canal by Syphon Drain.	Mean Depth.	To be passed through the Canal by Inlet and Outlet.	Mean Depth.	To be passed under the Canal by Culvert.	Mean Depth.	Aqueducts over Rivers.
From 4 to 6 feet broad. [No. 28]	1/5, 4/5, 6/10, 15/1½, 16/½, 17/1, 18/1, 19/1½, 21/1½, 22/1½; 26/2½, 28/1, 29/1, 31/2, 34/2, 38/1½, 41/1, 44/1, 49/1½; 51/1, 55/1, 56/1½, 59/2, 60/½, 61/2, 65/1½, 67/1, 43/1	[51.5]; say 2 feet; area of opening 10 square feet.	24/6, 39/6, 40/6, 45/3, 48/2, 54/9, 58/3, 71/6; 73/3¾, 84/½ [10]	[45¼]; 4½ feet; area of opening 22½ square feet.			
From 7 to 9 feet broad. [15]	5/8, 20/4¼, 23/4, 25/3, 27/3, 33/2, 35/2, 36/4, 42/3, 50/1; 63/3, 66/3, 70/1, 77/2, 32/2	[45¾]; 3 feet; area of opening 24 square feet.	46/3, 52/2, 53/2, 74/3½, 75/6, 83/3 [6].....	[19½]; 3 feet; area of opening 24 square feet.	91/2, 94/2	2; area 16.	No. 89, Runn Pitteanee River.... 780 feet section. No. 98, Wuttagee River ..... 800 " " No. 101, Peepul River .....1,000 " " Nos. 107, 108, 109, Mullear River. 1,750 " "
From 10 to 12 feet broad. [4]	2/9, 14/4, 41/4, 78/2	[19]; 4½ feet; area of opening 49½ square feet.	7/16, 8/16, 37/6, 47/3, 57/2, 72/3, 85/0.9, 90/3; 100/10 (opening 49.5) [8]	[49.75]; say 4.5 for water way.			
From 13 to 15 feet broad. [7]	3/10, 9/11, 12/8, 13/6, 30/3, 68/2, 69/3½	[43½]; 6 feet; opening 72 square feet.	76/4, 79/5, 80/6, 82/3 [4] (Area of opening 52 square feet)	[18]			
16 feet broad.....	10/12, 11/8	Say 10.....	81/5.				
20 feet broad.....	.....	.....	.....	.....	102/4	Area 80 feet.	
25 feet broad.....	64/3	.....	.....	.....	92/2, 93/5	91	
38 feet broad.....	62/4						
50 feet broad.....	.....	.....	86/2	Area 100 square feet			
60 feet broad.....	.....	.....	88/2	Do. 120 ditto.			

102 to 100 feet broad.....	.....	.....	$\frac{105}{13}$	Do. 132 ditto ..	$\frac{97}{7\frac{1}{2}}$	385
69 to 70 feet broad.....	.....	.....	$\frac{87}{2}$	Do. 138 ditto ..	$\frac{96}{7}$	490
200 feet broad.....	.....	.....	.....	.....	$\frac{95}{7\frac{1}{2}}$, $\frac{106}{2}$	850
75 feet broad.....	.....	.....	.....	.....	$\frac{103}{4}$	300
80 feet broad.....	.....	.....	.....	.....	$\frac{99}{5}$	400
100 feet broad.....	.....	.....	.....	.....	$\frac{104}{4}$	400

N.B.—The upper figures give the number of the watercourses, and the lower show the mean depth to high-water line.

W. CHAPMAN, Lieutenant,

Engineers.

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Abstract of Classification of Watercourses.

By Syphon Drain.			Inlet and Outlet.			By Culvert.			Aqueducts.
No.	Breadth and Mean Depth.		No.	Breadth and Mean Depth.		No.	Breadth and Mean Depth.		
28	4 to 6 feet broad; 2 feet deep	10	10	4 to 6 feet broad; 4½ feet deep....	22½				
15	7 to 9 feet broad; 3 feet deep	24	6	7 to 9 feet broad; 3 feet deep	49½	2	7 to 9 feet broad; 2 feet deep	16	
4	10 to 12 feet broad; 4½ feet deep ..	49½	8	10 to 12 feet broad; 4½ feet deep...	49¾				
7	13 to 15 feet broad; 6 feet deep	72	4	13 to 15 feet broad; 4½ feet deep...	52				
2	16 feet broad; 10 feet deep	Say 100	1	16 feet broad; 5 feet deep	80				
						1	20 feet broad; 4 feet deep	80	
1	25 to 27 feet broad; 3 feet deep....	78				2	25 to 27 feet broad; 3½ feet deep ..	91	
1	38 feet broad; 4 feet deep	144							
			1	50 feet broad	100				
			1	60 feet broad	120				
			1	102 to 110 feet broad	306	1	110 feet broad; 3½ feet deep	385	
			1	69 feet broad	138	1	70 feet broad; 7 feet deep	490	
						2	200 feet broad; 4½ feet deep	850	
						1	75 feet broad; 4 feet deep	300	
						1	80 feet broad; 5 feet deep	400	
						1	100 feet broad; 4 feet deep	400	
Totals..... 58			33			12			4

No. 89, Runn Pitteanee River .... 780 feet broad.
No. 98, Wuttagee River ..... 800 „ „ „
No. 101, Peepul River..... 1,000 „ „ „
Nos. 107, 108, 109, Mullear River ..1,750 „ „ „

W. CHAPMAN, Licutenant,
Engineers.

Kurrachee, October 1853.

APPENDIX G.

Results of Experiments carried on during the Inundation of 1853, *with a view to determining the Proportional Quantity, both as to Bulk and Weight, of Earthy Matter held in suspension by the Water of the Indus.*

The mean results of three experiments made by W. S. Cole, Esq., Deputy Collector at Jerruck, and of four experiments by G. Elander, Esq., Deputy Collector, at several places on the river below Tatta, the water having been evaporated by boiling, according to specific directions given: the calculations, made by myself from the packets of sediment and measurements forwarded, are as below:—

Proportion of Earthy Matter held in suspension during the Inundation.

	By Weight.	By Bulk.
Mr. Cole	$\frac{1}{296}$	$\frac{1}{312}$
Mr. Elander.....	$\frac{1}{288}$	$\frac{1}{304}$
Means....	$\frac{1}{292}$	$\frac{1}{308}$
From experiments by myself during the fair season	$\frac{1}{645}$	$\frac{1}{684}$

To apply the result of these experiments to the determination of the effect which the Indus water at inundation may have in silting up the canal:

The water stands in a reach, and is 6 feet in depth; therefore—

$6 \times 12 = 72$ inches depth.

$\frac{72}{292} = .247$ inch nearly, or say 0.25, or $\frac{1}{4}$ of an inch, is the maximum depth of earthy matter which could be deposited over the whole bottom of the canal.

But as the water in the different reaches will be periodically renewed by lockfulls passed with the boats using the canal, it is necessary to make an allowance for the increase of silt on this account.

Taking the first reach, from Jerruck to Lukka, as the one likely to be most affected—

Length 24.25 miles about

$\frac{76+58}{2}$ = mean breadth; and

67×6 depth $= 402 =$ area section area.

Therefore—

402×128040 feet $= 5147280$ cubic feet, which represents the volume of water required for once renewing this reach.

Then supposing, for the sake of argument, the regulation lock to be worked 6 months with the large gates $(24 - 6) = 18$ feet in height, and 6 months with the small gates $(15 - 6) = 9$ feet high,

$$\overset{\text{L.}}{130} \times \overset{\text{B.}}{22} \times \overset{\text{D.}}{13.5} = 38610 \text{ cubic feet}$$

would be the quantity passed by each boat. Multiplying this by the number of boats

supposed to pass through the canal yearly, or 5859, the result is 226215990 cubic feet; or the whole volume in the reach would be four times renewed, nearly, in the course of one year, and the deposition of silt would be increased in the same proportion.

The deposit in the course of one year would consequently amount to no more than 1 inch.

As the above calculations make allowance, from the water in the experiments having been evaporated by boiling, for the *maximum deposit* that can, under any circumstances, take place, it does not appear necessary to allow more than 10 inches, or sufficient to provide for the quantity of silt likely to be deposited in the course of ten years.

W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, November 1853.

APPENDIX H.

Memorandum of the Distances and Levels of the Canal, with the Falls and Rises to the different Bench Marks.

Names of Places having Bench Marks.	Main Line.	Check Line.	Difference.	Distance.			Intermediate Levels.	Remarks.
	F.	F.	F.	M.	F.	Y.		
PBM Jerruck.								
PBM Meanee	4.70	4.79	0.09	6	0	134	4.70	
BM Somera	5.42	5.53	0.11	7	6	114	10.12	
BM Duffranee	8.14	8.14	0.00	6	0	260	18.26	
PBM Lullung	0.71	1.37	0.66	3	0	425	18.97	Distance actually levelled 5 miles and 313 feet.
PBM Lukka.....	+6.70	+6.67	0.03	1	2	310	12.27	
PBM Gharra.....	−28.91	−29.12	0.21	29	6	492	41.18	
BM Wuttagee.....	4.53	5.12	0.59	9	5	378	45.71	
PBM Pimpree.....	+16.55	+16.32	0.23	4	3	510	29.16	
By BM Clifton to high-water mark, Bay	22.37	....	1.24	24	2	534	51.53	The high-water marks of the Harbour and Back Bay differ this much.
By Travellers' Bungalow to high-water mark, Harbour.....	....	23. 61						
Total fall.....−51.53			Distance..	92	4	417		

The above, though sufficiently good for most practical ordinary purposes, are not good levels. There was no time last season for further corrections.

W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, November 1853.

CANAL ESTIMATE.

CIVIL.

TERRITORIAL DEPARTMENT, REVENUE.

SCINDE DIVISION. PUBLIC WORKS.

Estimate, framed by Lieutenant CHAPMAN, Engineers, on Special Duty, Scinde, *of the probable Expense of constructing a navigable Canal from Jerruck, on the River Indus, to Kurrachee, including also the Works necessary for the perfecting and maintenance of the same, as a constant Line of Water Communication between the Indus and Kurrachee Harbour.*

AMOUNT OF ESTIMATE, *Rupees Forty-eight Lakhs, Fifty thousand, Seven hundred and Seventy-three.*

GENERAL DESCRIPTION.

The canal to be navigable throughout the year, by all description of Native river craft, as well as by small steamers, adapted to postal and other purposes requiring expedition. Its dimensions, calculated with this object, to be 79 feet top breadth, and 58 feet at the bottom, having a depth of water of 6 feet. Its length, including the cut into Kurrachee Harbour, to be 95 miles and 1,824 feet. The canal to be connected with the river at Jerruck by a regulation lock, providing for the highest and lowest levels of the Indus, and to terminate at Kurrachee in a fresh-water basin, having its bottom 6 feet below the high-water line. The intermediate fall of the country (from the level of canal bed at head to level of bottom of basin at tail), or 31 feet 6 inches, being disposed of by locks as below :—

	Fall in Feet.
Lock No. 1, Lukka	8.0
Lock No. 2, Runn Pitteanee	5.0
Lock No. 3, near Kurrachee	9.0
Lock No. 4, into Basin	9.6
Total fall	31.6

The locks, particularly the regulation lock at head, to be constructed in the most substantial manner, of hammer-dressed rubble stone and chunam masonry, all coigns and copings being of cut-stone ; a dam with escape-weir to be provided near Lakilat-foola, to guard against the flooding of the country below, should any accident happen to the lock-gates at head.

The store-houses, offices for establishment, and chokies, to be built of rough rubble stone masonry.

The slopes in embankments to be $1\frac{1}{2}$ to 1, and in cuttings on an average 1 to 1. All embankments to be strengthened with pise work, and a tow-path on either side of the canal, 12 feet broad, to be provided. (For General Section of Canal, both in Cuttings and Embankments, see Plate 10, and for details of Regulation Lock, see Plates 10 and 11, in accompanying Plans.)

CUTTINGS AND EMBANKMENTS.

The side slopes of the canal bed, both in cuttings and embankments, to have a slope of $1\frac{1}{2}$ to 1, and the cuttings above the level of the tow-path to be, on an average, finished off at 1 to 1.

The outer slopes of all embankments to be $1\frac{1}{2}$ to 1, and all embankments to be strengthened by pise work, as shown in Plate 10.

Earth Works.

(For Details of Measurement vide Section.)

Miles.	Cuttings.		Embankments.		Totals of Cuttings and Embankments.		Total of Pise Work.	
	Cubic Feet.	Dcls.	Cubic Feet.	Dcls.	Cubic Feet.	Dcls.	Cubic Feet.	Dcls.
1st ..	13,988,375.	68						
2nd ..	13,182,391.	06						
3rd ..	8,787,900.	18						
4th ..	8,972,266.	11						
5th ..	10,442,890.	97						
6th ..	15,297,563.	00						
7th ..	14,922,653.	90						
8th ..	10,576,143.	50						
9th ..	9,059,877.	60						
10th ..	8,984,655.	50						
11th ..	9,020,612.	40						
12th ..	8,165,188.	81						
13th ..	5,274,299.	93						
14th ..	8,367,602.	88						
15th ..	7,659,146.	48						
16th ..	7,343,759.	64	.....		7,343,759.	64		
17th ..	7,088,946.	10	.....		7,088,946.	10		
18th ..	6,528,860.	04	.....		6,528,860.	04		
19th ..	4,150,166.	72	2,513.	00	4,152,679.	72	700.	00
20th ..	3,219,626.	28	4,071.	06	3,223,697.	34	1,134.	00
21st ..	3,155,592.	00	.....		3,155,592.	00		
22nd ..	3,009,072.	00	.....		3,009,072.	00		
23rd ..	2,851,240.	40	2,579.	50	2,853,819.	90	700.	00
24th ..	1,355,699.	88	618,689.	73	1,974,389.	61	153,208.	25
25th ..	5,539,469.	11	98,023.	99	5,637,493.	10	23,033.	00
26th ..	5,300,467.	00	.....		5,300,467.	40		
27th ..	4,622,671.	44	.....		4,622,671.	44		
28th ..	3,810,139.	40	.....		3,810,139.	40		
29th ..	4,091,141.	06	.....		4,091,141.	06		
30th ..	3,337,130.	64	1,105.	72	3,338,236.	36	308.	00
31st ..	3,589,882.	90	10,047.	24	3,599,930.	14	2,658.	00
32nd ..	4,030,377.	28	.....		4,030,377.	28		
33rd ..	2,323,829.	20	190,120.	56	2,513,949.	76	48,102.	00
34th ..	2,571,128.	05	168,614.	78	2,739,742.	83	40,532.	00
35th ..	2,435,096.	72	150,489.	00	2,585,585.	72	36,852.	00
36th ..	2,828,719.	23	38,451.	28	2,867,170.	51	10,192.	00
37th ..	3,326,175.	25	.....		3,326,175.	25		
38th ..	2,146,728.	20	268,666.	70	2,415,394.	90	64,141.	25
39th ..	691,022.	70	1,120,915.	30	1,811,938.	00	283,738.	75
40th ..	1,447,031.	77	638,876.	87	2,085,908.	64	153,743.	25
41st ..	1,729,365.	01	481,442.	72	2,210,807.	73	112,341.	50
42nd ..	1,243,112.	95	750,714.	64	1,993,827.	59	180,172.	00
43rd ..	811,853.	21	1,040,246.	06	1,852,099.	27	262,152.	50
44th ..	2,764,732.	29	201,758.	58	2,966,490.	87	47,385.	25
45th ..	4,915,058.	90	.....		4,915,058.	90		
46th ..	6,395,430.	79	.....		6,395,430.	79		
47th ..	8,209,452.	50	.....		8,209,452.	50		
48th ..	6,005,485.	41	.....		6,005,485.	41		
49th ..	854,218.	19	1,139,224.	75	1,993,442.	94	624,745.	00
50th ..	3,219,965.	61	218,588.	25	3,438,553.	86	52,084.	00
51st ..	1,590,012.	36	554,879.	67	2,144,892.	03	141,568.	00
Cd. over.	281,234,228.	63	7,700,019.	40	288,934,248.	03	2,239,490.	75

Miles.	Cuttings.		Embankments.		Totals of Cuttings and Embankments.		Total of Pise Work.	
	Cubic Feet.	Dcls.	Cubic Feet.	Dcls.	Cubic Feet.	Dcls.	Cubic Feet.	Dcls.
Bt. over.	281,234,228.	63	7,700,019.	40	288,934,248.	03	2,239,490.	75
52nd ..	488,371.	99	1,267,698.	55	1,756,070.	54	324,648.	50
53rd ..	157,780.	27	1,634,498.	63	1,792,278.	90	401,040.	25
54th ..	2,425,679.	48	923,236.	74	3,348,916.	22	322,888.	23
55th ..	.....		3,746,995.	51	3,746,995.	51	2,008,955.	33
56th ..	.....		3,394,691.	86	3,394,691.	86	1,838,887.	00
57th ..	25,803.	00	4,372,840.	40	4,398,643.	40	1,923,411.	68
58th ..	927,035.	58	1,207,313.	00	2,134,348.	58	290,730.	52
59th ..	5,589.	00	4,222,024.	88	4,227,610.	88	1,703,882.	00
60th ..	.....		6,506,907.	52	6,506,907.	52	2,328,480.	00
61st ..	.....		5,845,092.	20	5,845,092.	20	2,328,480.	00
62nd ..	.....		6,513,987.	20	6,513,987.	20	2,328,480.	00
63rd ..	.....		6,410,612.	12	6,410,612.	12	2,328,480.	00
64th ..	.....		6,146,460.	27	6,146,460.	27	2,060,960.	25
65th ..	.....		4,504,115.	64	4,504,115.	64	1,823,848.	00
66th ..	.....		6,149,976.	89	6,149,976.	89	2,248,220.	00
67th ..	274,549.	50	5,201,388.	79	5,475,938.	29	1,895,205.	00
68th ..	11,928,768.	52	.....		11,928,768.	53		
69th ..	2,185,378.	16	895,215.	36	3,080,593.	52	677,907.	00
70th ..	.....		7,049,509.	64	7,049,509.	64	2,167,980.	00
71st ..	.....		7,499,550.	24	7,495,550.	23	2,328,480.	00
72nd ..	.....		7,185,798.	49	7,185,798.	49	2,328,480.	00
73rd ..	.....		8,713,475.	34	8,713,475.	34	2,328,480.	00
74th ..	.....		10,154,580.	76	10,154,580.	76	2,328,480.	00
75th ..	.....		83,855,506.	65	8,385,506.	65	2,328,480.	00
76th ..	1,644,839.	08	5,360,371.	12	7,005,210.	20	1,698,174.	00
77th ..	.....		8,135,313.	91	8,135,313.	91	2,328,480.	00
78th ..	.....		8,598,767.	43	8,598,767.	43	2,328,480.	00
79th ..	.....		8,268,594.	61	8,268,594.	61	2,328,480.	00
80th ..	.....		9,595,677.	67	9,595,677.	67	2,328,480.	00
81st ..	3,841,812.	04	7,226,479.	20	11,068,291.	24	1,800,138.	00
82nd ..	25,797,659.	20	.....		25,797,659.	20		
83rd ..	34,560,528.	16	.....		34,560,528.	16		
84th ..	18,021,993.	51	.....		18,021,993.	51		
85th ..	1,440,045.	92	1,046,802.	46	2,486,848.	38	208,483.	50
86th ..	110,107.	18	2,152,276.	74	2,462,383.	92	673,105.	24
87th ..	.....		5,390,414.	25	5,390,414.	25	2,312,242.	75
88th ..	.....		3,348,050.	50	3,348,050.	50	1,830,859.	00
89th .	.....		6,311,396.	88	6,311,396.	88	1,952,808.	25
90th ..	6,669,471.	26	2,537,999.	55	9,207,470.	81	747,908.	00
91st ..	7,984,143.	55	.....		7,984,143.	55		
92nd ..	1,422,207.	20	1,457,210.	43	2,879,417.	63	381,526.	75
93rd ..	.....		1,780,206.	40	1,780,206.	40	533,821.	50
	401,145,991.	24	19,68,37,054.	22	597,983,045.	46	64,337,361.	50

Abstract.

Items.	Rs.	A.	P.
401,145,991·24 cubic feet of cutting, at 5 annas for 100 cubic feet as a mean..	12,53,581	3	6
196,837,054·22 cubic feet embankment, at 5 annas, also to allow of, in some cases, soil being brought a short distance	6,15,115	12	8
64,337,361·30 pise work in enbankments, at 12 annas per 100 cubic feet..	4,82,530	8	4
	23,51,227	8	6
Add 5 per cent. for tools and contingencies.	1,17,561	6	0
Total....	24,68,788	14	6

Regulation Lock at Canal-head.

This work to consist of two lock-chambers, each 130 feet long by 22 feet broad, the whole to be built on strong inverted arches, and the pavements at both ends to be further secured by rubble stone fillings, and rows of stout teak-wood piling. Each lock-chamber to be provided with a double set of gates, the one set, 15 feet in height, to be worked during the fair season; and the other, 25 feet 3 inches high, to be kept in good repair, and available for any sudden rise of the river, and to be used during the inundation only. The lock works to be kept retired within the bank of the river, and connected with it by wing walls 176 and 315 feet long respectively, a channel and basin being dredged to the depth required. (For details of Lock vide Plates 10 and 11.)

Measurements.

	Cubic Feet. Dcls.
Excavation by Dredging.	
Deepening river bed at mouth of lock	156,400. 0
Excavation in Hard Soil.	
For lock mouth, including wing walls	986,875. 5
For body of lock	513,751. 0
Connection of canal and lock, including retaining walls	231,660. 0
Ramps and slopes	72,124. 0
Total excavation in hard soil	1,804,410. 5
Stone and Chunam Masonry.	
Pavement of mouth, including circular recess foundations	11,970. 0
Pavement of lock not arched	22,785. 0
Total pavements	34,755. 0
Inverted arch pavements	34,438. 0
Side and Wing Wall of Lock.	
Pilaster of front wing walls	27,120. 0
Side walls	88,689. 0
Circular end	1,567. 9
Steps	33,520. 9
Front wing wall, including foundations	93,584. 6
Straight wing walls	12,006. 0
Circular recess front wing walls	1,153. 5
Total stone and chunam	257,641. 9
Centre pier, not deducting staircases, arch work, &c. all work included.	65,184. 0
Cut-stone Work.	Running Feet.
Coping of circular wing walls	491. 00
Coping of straight portion wing walls	230. 00
Coping of pilasters ..... Square Feet	896. 25

	Cubic Feet.
Stone Filling.	
Mouth apron	1,890
Tail apron	2,380
Total stone filling	4,270
Teak-wood Piling.	No.
At mouth apron	270
At tail apron	324
Total piles with shoes	594
Iron Piping for Sluices.	lbs.
Iron piping 2 feet in diameter, and of 1-inch metal, 464 running feet, at 250 lbs. per lineal foot, or	116,000
Wood Work of Lock-gates and Sill.	Cubic Feet. Dcls.
Large lock-gates, each leaf 25 feet 3 inches by 12 feet 6 inches, frame-work of teak-wood	174. 5
4-inch planking, each leaf	105. 41
	279. 91
No. of leaves in four gates	8
Cubic feet teak-wood, large gates	2,239. 28
Small lock-gates, each leaf 15 feet by 12 feet 6 inches, frame-work	121. 0
Planking	62. 5
	183. 5
For four gates	8
Cubic feet teak-wood, small gates	1,468. 0
Total cubic feet teak-wood in gates	3,707. 28
Teak-wood for gate sill platform 40 logs 25 feet long and 1 foot square.	1,000. 0
Gate sills No. 16 × 14 feet × 1 × 1	224. 0
Gate sill struts	80. 0
Total teak-wood for platforms and sills	1,304. 0
Iron Work of Gates and Sills.	lbs.
Wrought iron anchor hinges, weight of each hinge 64·86 lbs., 3 pairs for each large gate leaf, and 2 pairs for each small ditto, or 40 hinges.	2,594. 4
Iron clamps for sill struts, each 4′ × 3″ × 2″ No. 96, weight per foot 19·6 lbs.	1,881. 6
Miscellaneous small iron work	750. 0
Total iron work for gates	5,226. 0
Iron Chain for Gates.	Running Feet.
Iron chain, at 32 lbs. to a fathom, length 32 × 50	1,600. 0
	No.
Winches, small	32

Abstract Regulation Lock.

Items.	Rs.	A.	P.
156,400 cubic feet excavation by dredging, at Rs. 1-8-0 per 100 cubic feet	2,346	0	0
1,804,410·5 cubic feet excavation in hard soil, at 8 annas per 100 cubic feet	9,022	0	10
34,755 cubic feet stone and chunam masonry for pavements, at Rs. 15 per 100 cubic feet	5,213	4	0
34,438 cubic feet inverted arch work, at Rs. 20 per 100 cubic feet.	6,887	9	7
257,641·9 cubic feet stone and chunam masonry in lock and wing walls, at Rs. 15 per 100 cubic feet.	38,646	4	7
65,184 cubic feet masonry in central pier, making no deductions on account of arch work, staircases, &c., at Rs. 18 per 100 cubic feet	11,733	1	11
491 running feet coping of corresponding wing walls, at Rs. 3 per foot	1,473	0	0
230 running feet coping of straight portion wing walls, at Rs. 3-8-0 per foot	805	0	0
896·25 square feet coping of square pilasters, at Rs. 1 per square foot	896	4	0
4,270 cubic feet rough stone filling fitted above, at Rs. 4-8-0 per 100 cubic feet	192	2	4
594 teak-wood piles, with shoes, including driving, 7′ × 9″ × 9″, at Rs. 8 each	4,752	0	0
116,000 lbs. of iron piping, 2 feet diameter, cost in England £7 per ton, add 25 per cent. for freight and carriage	4,531	4	0
3,707 cubic feet of teak-wood in large and small gates, at Rs. 1-12-0 per foot, including carpentery	6,487	4	0
White lead and tallow, fixing gates, &c.	500	0	0
1,304 cubic feet of teak-wood for sill platforms, gate sills, and sill struts, at Rs. 1-4-0 per foot	1,630	0	0
5,226 lbs. of iron for hinges, clamps, and miscellaneous, at 6 annas per lb., including smiths' work, &c.	1,959	12	0
1,600 running feet of iron chain, at 7*s.* 6*d.* per fathom in England, add 25 per cent. for freight and carriage	1,250	0	0
32 small winches, cost in England £6 10*s.* each, add 25 per cent. as above	2,600	0	0
	1,00,799	15	3
Contingencies 5 per cent.	5,039	15	11
Total amount for regulation lock .. .. Rs.	1,05,839	15	2

Dam and Escape-weir.

This work to consist of five strong piers of stone and chunam masonry, one 12 feet thick, in the centre of the canal bed, and one on either side of the tow-path, on each bank of the canal; the inner and outer being 10½ and 10 feet in thickness respectively. These piers to be connected below by inverted arches, and above, over the tow-path only, by arched masonry, and on both sides with the banks. The four openings thus formed to be provided with gates similar to those of the regulation lock, and these to be further protected by log-sleepers in advance (like those in use in the North-West Province canals), strengthened by struts; the whole work to form an obstacle across the canal cutting 1 foot higher than the high inundation water-line at head.

The escape, 100 feet broad, to be constructed in the left bank of the canal, communicating with a cut now existing, and to be formed of two wing walls 200 and 250 feet long respectively; the lower wall being connected with the dam, and most substantially

built. The whole of the escape, including the tow-path and slope of the canal bed, to be strongly paved, the angle formed by the tow-path and slope being further strengthened by a wall 9 feet deep by 3 feet thick, throughout the whole length of the pavement.

The lower end of the escape pavement to be secured by teak-wood piling, with an apron of rubble stone.

The escape opening to be partially filled in with an earthen bund over the pavement, to keep out the river water from the cut at ordinary inundations.

MEASUREMENTS.

	Cubic Feet.	Dcls.
Excavation.		
For escape	453,600.	0
Filling in over pavements when finished	100,000.	0
Foundation of centre pier	2,016.	0
Foundation of side piers	3,528.	0
Ditto ditto	10,800.	0
Under tow-path	10,080.	0
Total excavation in earth	580,024.	0
Masonry, Stone and Chunam.		
Centre pier	14,136.	0
Side pier	24,738.	0
Ditto	20,010.	0
Walls across tow-path	2,592.	0
Wing walls, right	74,400.	0
Wing walls, left	36,000.	0
Connecting wall on right bank of canal	1,140.	0
Wall to strengthen angle of tow-path	4,050.	0
Pavement of tow-path and canal side slope	7,500.	0
Pavement of cut	45,000.	0
Total feet rubble masonry	229,566.	0
Arch Work.		
Under flooring large chambers	8,484.	0
Under and above tow-path	3,744.	0
Total arched masonry	12,228.	0
Lock-gates.		
For gates, four 28 x 14, and two 21 x 13.5 feet	1,697.	46
For log-sleepers and struts.	1,350.	00
For sill platforms	380.	00
For sills	56.	00
For sill struts	20.	00
Cubic feet teak-wood	456.	00
Miscellaneous.	No.	
Piles, teak-wood, 8 feet long x 1 x 1 inch waling	100	
White lead and tallow, &c.	lot.	
Winches, small	3	
Iron chain, 32 lbs. to fathom	250	Feet.

		lbs.	Dcls.
Hinges, wrought iron, anchor, weight of each 64.86 lbs, 3 pairs for each large gate, and 2 pairs for each small ditto	16 pairs..	1,037.	8
Miscellaneous iron work		323.	2
Total iron work..		1,361.	0

Abstract of Dam and Escape-weir.

Items.	Rs.	A.	P.
580,024 cubic feet excavation in earth, at 4 annas per 100 cubic feet	1,450	0	11
229,566 cubic feet of stone and chunam masonry, mean rate Rs. 18 per 100 cubic feet	41,321	14	0
12,228 cubic feet arch masonry, at Rs. 20 per 100 cubic feet ..	2,445	9	7
1,697·46 cubic feet teak-wood for gates, including carpenters, &c., at Rs. 1-12-0 per cubic foot	2,970	8	10
1,350 cubic feet for log-sleepers, and struts of teak-wood, at Rs. 1-12-0, including carpenters' work	2,362	8	0
456 cubic feet teak-wood for platforms and sills, at Rs. 1-4-0 per cubic foot	570	0	0
100 cubic feet teak-wood for piling, at Rs. 8 each, including driving	800	0	0
White lead, tallow, &c. for hanging gates	125	0	0
3 small winches (as before) £6 10*s.* each, add 25 per cent. ..	243	12	0
250 feet of chain, iron, at 7*s.* 6*d.* per fathom, add 25 per cent. ..	195	5	0
1,361 lbs. iron work for hinges, &c., at 6 annas per lb., including smiths' work	510	6	0
	52,995	0	4
Add 5 per cent. contingencies	2,649	12	0
Amount of dam and escape-weir .. .. .. Rs.	55,644	12	4

Aqueducts.

These works (vide "Abstract of Classification of Watercourses," Appendix to Estimate F) are required for the following rivers:—

	Length of section.	
No. 89, Runn Pitteanee River ..	780 feet.	With a breadth of waterway of 30 feet, and allowing path of 8 feet on either side.
No. 98, Wuttagee River	800 „	
No. 101, Peepul River	1,000 „	
Nos. 107, 108, 109, Mullear River, three branches	1,750 „	

[N.B.—To avoid the labour and time required for making out detailed plans and estimates for these works, a rough estimate only is submitted.]

The Solani Aqueduct, on the Ganges Canal, affords the best example of the style of construction required, the block-sinking used in its foundations being especially appli- to the Mullear and Pimpree Rivers.

The cost of the Solani Aqueduct, as estimated, was about Rs. 2,90,000. The length, taken at 650 feet, gives Rs. 446 for each foot of section. Making the necessary allowances for the difference of the areas of the waterways, (the Solani having an area of 760 feet, and that of those now under consideration being 322 feet,) and taking into account, also, the height of the different constructions, as well as the comparatively high price of labour in Scinde, the following rates for each of the aqueducts may be allowed:—

Abstract of Aqueducts.

Names.	Rs.	A.	P.
No. 89, Runn Pitteanee River, 780 feet in section, at Rs. 250 per foot	1,95,000	0	0
No. 98, Wuttagee River, 800 feet section, at Rs. 250 per foot ..	2,00,000	0	0
No. 101, Peepul River, 1,000 feet section, at Rs. 275 per foot ..	2,75,000	0	0
Nos. 107, 108, 109, Mullear River, 1,750 feet, at Rs. 300 per foot..	5,25,000	0	0
	11,95,000	0	0
Add 5 per cent. contingencies	59,750	0	0
Total amount for aqueducts .. .. .. Rs.	12,54,750	0	0

SMALL LOCKS.

In order to dispose of the fall shown by the sections, from the assumed lowest level of the Indus at the head, to the bottom level of the canal basin at Kurrachee, 31 feet 6 inches, four locks are required, as follows:—

	Fall in Feet.
Lock No. 1, near Lukka	8. 0
Lock No. 2, Runn Pitteanee	5. 0
Lock No. 3, near Kurrachee	9. 0
Lock No. 4, into Basin	9. 6
Total fall..	31. 6

Each lock to have two chambers, each 130×22 feet long, with inverted arch floorings, to be built on the ordinary principle of drop-locks, and of rubble stone and chunam masonry, with cut-stone coigns.

No. 1.—*For a Lock of* 8 *Feet Fall.*

MEASUREMENTS.

Excavation.

(Provided for in Canal Section.)

Masonry, Stone and Chunam, Arched.	Cubic Feet.	Dcls.
Flooring of chambers	24,907.	5
Block arch work to gates	1,215.	0
Total arched masonry	26,122.	5
Rubble Stone and Chunam Masonry, with Cut-stone Coigns.		
Pavements, flat	1,716.	0
Ditto, mouth	17,685.	0
Ditto, upper end	3,672.	0
Abutments	9,888.	0
Counterforts	1,440.	0
Ditto, behind gates	7,888.	0
Wing walls, straight, including counterforts	3,060.	0
Curved ditto	4,032.	0
Head wall.	1,056.	0
Do. buttress	990.	0
Centre pier, 1st portion	13,824.	0
Ditto, remainder	1,848.	0
Total masonry	67,099.	0

Lock-gates.

	Square Feet.
Four 12×15, and four 12×7	1,056

Miscellaneous.

Four winches, with apparatus for opening sluices, white lead, &c. .. lot.

Proportion to be added or deducted for 1 foot more or less fall, in otherwise similar locks :—

MEASUREMENTS.

Masonry.

	Cubic Feet.
Abutments	824
Counterforts	120
Ditto behind gates	464
Wing walls, straight..	360
Ditto, curved	336
Centre pier	1,152
Total masonry..	3,256
Gates.. .. .. Square Feet	48
Miscellaneous	lot.

Abstract of Small Locks.

Items.	Rs.	A.	P.
26,122·5 cubic feet arched masonry, at Rs. 20 per 100 cubic feet. ..	5,224	8	0
67,099 cubic feet stone and chunam masonry, at Rs. 16 per 100 cubic feet	10,735	13	5
1,056 square feet lock-gates, at Rs. 2½ per square foot, including iron work, &c.	2,640	0	0
4 windlasses, with apparatus for opening sluices, &c.	500	0	0
	19,100	5	5
Add contingencies, at 5 per cent.	955	0	3
No. 1, amount for a lock of 8 feet fall.. .. Rs.	20,055	5	8

Proportion for 1 foot fall, more or less :—

Abstract.

Items.	Rs.	A.	P.
3,256 cubic feet stone and chunam masonry, at Rs. 15 per 100 cubic feet	488	6	5
48 square feet lock-gates, at Rs. 2½ per square foot	120	0	0
Proportion of miscellaneous	20	0	0
	628	6	5
Contingencies, at 5 per cent.	31	6	8
Proportion to be added or deducted for 1 foot.. .. .. Rs.	659	13	1
No. 3.—*For a Lock of 9 Feet Fall.*			
Total amount No. 3 .. .. Rs.	20,715	2	9

No. 2.—*For a Lock of* 5 *Feet Fall.*

Total for 8 feet fall	Rs.	20,055	5	8
Deduct proportion for 3 feet		1,979	7	3
Total amount for lock No. 2 ..	Rs.			18,075 14 5

No. 4.—*For a Lock of* 9½ *Feet Fall.*

Total for 9 feet fall	Rs.	20,715	2	9
Add proportion for ½ foot		329	14	7
Total amount for lock No. 4 ..	Rs.			21,045 1 4
Total amounts of locks Nos. 1, 2, 3, and 4... ..	Rs.			79,891 8 2

Watercourses.

General Remarks.

The watercourses are disposed of according to the height of their beds with reference to that of the canal, and are arranged under the following heads, having been first classified by the areas of their waterways (vide Classification of Watercourses, Appendix F to Estimate):—

No. 1, to be taken under the canal by syphon drain, as practised in Italy.

No. 2, to be passed through the canal by inlet and outlet.

No. 3, to be passed under the canal by culvert.

All to be built of rubble stone and chunam masonry (with arches of brick, if available), with cut-stone coigns.

[N.B.—In the following estimates a syphon drain is calculated for 10 square feet of waterway, and as many of these openings are adapted to each watercourse, under this head, as are required by its area of waterway.

An inlet with its outlet is calculated for 25 square feet waterway, and a culvert for 50 square feet waterway; such a number of openings being allowed to each watercourse under these heads as they respectively require.]

SYPHON DRAIN.

Measurements.

Excavation.

	Cubic Feet.
Below canal bed	6,174
On slope	3,888
Total excavation in earth..	10,062

Stone and Chunam Arch Work.

Of drain	3,762

Stone and Chunam Masonry.

Pavement bed of nullah	285
Head and wing wall	435
Buttresses at angles	96
Total masonry	816

Abstract.

Items.	Rs.	A.	P.
10,062 cubic feet excavation in earth, at 6 annas per 100 cubic feet ..	37	11	8
3,762 cubic feet arched masonry, at Rs. 20 per 100 cubic feet	752	6	4
816 cubic feet stone and chunam masonry, at Rs. 15 per 100 cubic feet.	122	6	4
	912	8	4
Add 5 per cent. contingencies	45	10	0
Total syphon drain of 10 feet waterway .. .. Rs.	958	2	4

Abstract of No. and Cost of Syphon Drains of various Openings, as shown to be required in Classification of Watercourses. (Appendix F.)

No.	No. of Waterways required.	Rs.	A.	P.	Per	Rs.	A.	P.
28	Single	958	2	4	each	26,828	1	4
15	Double	1,916	4	8	„	28,744	6	0
4	Five	4,790	11	8	„	19,162	14	8
7	Seven	6.707	0	4	„	46,949	2	4
2	Ten	9,581	7	4	„	19,162	14	8
1	Eight	7,665	2	8	„	7,665	2	8
1	Fourteen	13,414	0	8	„	13,414	0	8
58	syphon drains, amount .. .. Rs.					1,61,926	10	4

INLET AND OUTLET.

MEASUREMENTS.

Digging Foundation.

	Cubic Feet.	Dcls.
Inner wing walls	810.	0
Outer ditto	468.	0
Abutments	1,015.	0
Pavements	585.	0
Ditto bay and rear	457.	50
Centre wall	60.	0
Between piers (for masonry 3,395·5)	386.	25
Total for foundation	3,781.	75

Masonry, Stone and Chunam.

As above	3,395. 5

Miscellaneous.

	No.
Cut-stone for groves and sill	16
Planks 6 feet × 1 × 3 inches	12

Iron Work.

Square feet of boarding, and joists for flooring of roadway	60

Additional Work for each Extra Bay.

	Cubic Feet.	Dcls.
Digging foundation in earth	3,378.	5
Masonry and chunam	1,616.	75
	No.	
Cut-stones as above	16	

Abstract.

Items.	Rs.	A.	P.
3,781·75 cubic feet digging foundation in earth, at 4 annas per 100 cubic feet	9	7	3
3,395·5 cubic feet stone and chunam masonry, at Rs. 15 per 100 cubic feet	509	5	2
16 cut-stones for groves and sills	72	0	0
12 plank sleepers, at Rs. 3 each, including carpentry	36	0	0
Iron work, &c.	25	0	0
60 square feet boarding, and joists for roadway, at Rs. 1 per square foot	60	0	0
	711	12	5
Add contingencies 5 per cent.	35	9	2
Total for outlet, 25 square feet	747	5	7
Add for inlet, the same	747	5	7
Total for outlet and inlet single opening .. Rs.	1,494	11	2

Abstract for each Additional Bay.

Items.	Rs.	A.	P.
3,378·5 cubic feet digging foundation, at 4 annas per 100 cubic feet ..	8	7	1
1,616·75 cubic feet stone and chunam masonry, at Rs. 15 per 100 cubic feet	242	8	2
16 cut-stones, planking, &c. as above	193	0	0
Add for contingencies 5 per cent.	22	3	2
Total for outlet	466	2	5
Add for inlet same	466	2	5
Total amount for outlet and inlet, additional opening of 25 square feet .. .. Rs.	932	4	10

Abstract of No. and Cost of Outlets and Inlets of various Waterways, as shown to be required in Classification of Watercourses (Appendix I).

No.	No. of Waterways required.	Rs.	A.	P.	Per	Rs.	A.	P.
10	Single	1,494	11	2	Each.	14,946	15	8
18	Double.	2,427	0	0	„	43,686	0	0
1	Three	3,359	4	10	„	3,359	4	10
1	Four	4,291	9	8	„	4,291	9	8
1	Five	5,223	14	6	„	5,223	14	6
1	Six	6,156	3	4	„	6,156	3	4
1	Twelve	11,750	0	4	„	11,750	0	4
33	outlets and inlets, amount .. .. Rs.					89,414	0	4

CULVERTS.

MEASUREMENTS.

Digging Foundation.

	Cubic Feet.	Dcls.
Abutment walls	8,832.	0
Pavements	2,460.	0
Total digging foundation, earth	11,292.	0

Stone and Chunam Masonry.

Abutments	8,379.	0
Counterforts	1,064.	0
Foundation wing walls	1,368.	0
Ditto ditto	750.	0
Pavement	1,890.	0
Ditto	855.	0
Head wall above and below ground	240.	0
Total masonry	14,546.	0
Arched Masonry	4,095.	0

For Additional Waterway of the same size.

Digging Foundation	Pier foundation	2,268.	0
	Pavement	1,710.	0
Total digging foundation		3,978.	0
Masonry	Pier	3,628.	8
	Pavement	2,631.	0
	Head wall	240.	0
Total masonry		6,499.	8
Arched Masonry, as above		4,095.	0

Abstract.

Items.	Rs.	A.	P.
11,292 cubic feet digging foundation, at 4 annas per 100 cubic feet	28	3	8
4,095 cubic feet arched masonry, at Rs. 20 per 100 cubic feet	819	0	0
14,546 cubic feet stone and chunam masonry, at Rs. 15 per 100 cubic feet	2,181	14	5
	3,029	2	1
Add contingencies 5 per cent.	151	7	3
Amount for culvert single waterway Rs.	3,180	9	4

Abstract for Additional Waterway.

Items.	Rs.	A.	P.
3,978 cubic feet digging foundation, at 4 annas per 100 cubic feet	9	15	1
6,499·8 cubic feet masonry, at Rs. 15 per 100 cubic feet	974	15	6
4,095 cubic feet arched masonry, at Rs. 20 per 100 cubic feet	819	0	0
	1,803	14	7
Add contingencies 5 per cent.	90	3	1
Amount for additional waterway and culvert Rs.	1,894	1	8

Abstract of No. and Cost of Culverts of various Waterways, as shown to be required in Classification of Watercourses.

No.	No. of Waterways required.	Rs.	A.	P.	Per	Rs.	A.	P.
2	Single	3,180	9	4	Each	6,361	2	8
3	Double	5,074	11	0	„	15,224	1	0
1	Seven	14,545	3	4	„	14,545	3	4
3	Ten	20,227	8	4	„	60,682	9	0
1	Twelve	24,015	11	8	„	24,015	11	8
2	Twenty	39,168	9	0	„	78,337	2	0
12	culverts, amount..				..Rs.	1,99,165	13	8

Road Bridges.

General Description.

Road bridges will be required at present at the following places:—Kurrachee, Pimpree, Gharra, Halla, Chettee, Jerruck.

Any additional communications, by means of foot bridges or rafts, that may hereafter be found necessary, will be provided out of the contingencies of the work.

The bridges to be built of rubble stone and chunam masonry, and to consist of two arches, each 36 feet 5 inches span, with a rise at the crowns of 11 feet above the level of the tow-path. The tow-path on either side to be carried under the archway, and to be 10½ feet in width.

The roadway to be 25 feet broad, and the approaches to have a slope of 1 in 20.

Measurements.

	Cubic Feet.	Dcls.
Digging Foundation.		
Abutments	4,320.	00
Wing walls	2,640.	00
Ditto	2,394.	00
Tow-path wall	1,188.	00
Pier	1,584.	00
Total excavation in earth	12,126.	00
Masonry, Stone and Chunam.		
Abutments	9,360.	00
Wing walls	8,778.	00
Ditto	5,685.	75
Tow-path wall	3,300.	00
Wall above abutments	2,131.	50
Pier	1,344.	00
Spandril walls	864.	00
Parapet ditto	1,102.	50
Loading	3,168.	00
Total masonry	35,733.	75
Cut-stone Work.	Running Feet.	
Coping	294.	00
String course	294.	00
Total cut-stone work	588.	00

	Cubic Feet.
Arched Masonry..	5,292
Earth Embankments, &c.	
Embankments, slope 1 in 20	666,045
Filling in roadway above arch	25,938
	691,983
Deduct earthwork available from foundation and loading	15,294
Total embankments and filling earth..	676,689

Abstract.

Items.	Rs.	A.	P.
12,126 cubic feet digging foundation in earth, at 4 annas per 100 cubic feet	30	5	0
35,733·75 cubic feet stone and chunam masonry, at Rs. 15 per 100 cubic feet	5,360	1	0
5,292 arch work cubic feet, at Rs. 25 per 100 cubic feet, including centering	1,323	0	0
588 running feet cut-stone work, at Rs. 1 per foot	588	0	0
676,689 cubic feet earthwork in embanking and filling, at 5 annas 100 cubic feet..	2,114	10	5
	9,416	0	5
Add contingencies 5 per cent	470	12	10
Amount for one bridge .. . . Rs.	9,886	13	3
Amount for six bridges .. .. Rs.	59,320	15	6

COMMUNICATION WITH THE HARBOUR.

Basin, Dock, and Cut.

General Description.

The canal basin to be 1,500 feet long by 500 feet broad, with a depth of water of 6 feet. The dock to be separated from the basin by a wharf pier 40 feet broad, and to have a length of 1,500, with a breadth of 300 feet.

Both dock and basin, omitting in the former the mouth of the cut, to be lined with walls of rubble stone and chunam masonry. The centre wharf walls to have a rear paddling of blue clay. The roadway of the wharf pier to be strongly paved, a roadway of communication 30 feet broad to extend all round both basin and dock; this to be connected with the town by the road shown in the plan (Plate 9).

The wharf pier to be provided with 20 cranes, each of two tons power, strongly set in masonry in the centre of the roadway.

The cut to the harbour to be 13,667 feet in length, to have a breadth at top of 100, and at bottom of 75 feet. The cut to be strengthened by teak-wood piles 20 feet apart, driven to correspond with the slope of its sides, and extending 4 feet below its bed. The piles to be connected by waling pieces above, and the intervals between them to be fitted with strong rubble stone pavement to a depth of 10 feet, or a little more than the ordinary difference of rise and fall of tide.

Measurements.

Excavation.

	Cubic Feet.	Dcls.
Basin, including foundation of wall	4,596,384.	0
Dock, ditto ditto ditto	1,048,815.	0
Cut	20,500,500.	0
Total excavation in mud and water	26,145,699.	0

Stone and Chunam Masonry.

Walls of basin	132,396.	0
Wall of pier on dock side	113,062.	5
Walls of dock	11,812.	5
Pavement of wharf pier	90,000.	0
Bed of crane fixings	3,000.	0
Total masonry	350,271.	0

Cut Lining.

Piling.

	No.	
Teak-wood piles driven in at 20 feet apart, corresponding with the slope of the sides of cut with waling	1,366.	7

Rubble Stone Pavement.

	Square Feet.
In the intervals between the piles	311,616

Miscellaneous.

	No.
Cranes of 2 tons each	20
Fixing above, &c.	lot.

Abstract.

Items.	Rs.	A.	P.
26,145,699 cubic feet of excavation in mud and water, at Rs. 1 per 100 cubic feet	2,16,457	0	0
350,271 cubic feet stone and chunam masonry, at Rs. 15 per 100 cubic feet	52,540	10	5
1,367 teak-wood piles, 20 feet long, including waling pieces, and driving, at Rs. 25 each	34,175	0	0
311,616 square feet of pavement to sides of cut, at Rs. 10 per 100 square feet	31,161	9	7
20 cranes, at £50 each in England, add 25 per cent. carriage and fixing	12,500	0	0
	3,46,834	4	0
Add 5 per cent. contingencies	17,341	11	4
Total amount for basin, dock, and cut .. Rs.	3,64,175	15	4

Buildings.

The following buildings, store-houses, and chowkies, will be required :—

At Kurrachee.—An Overseer and Collector's house at basin; a store-house for tools, &c., and workshop ; a Lockman's shed.

At Jerruck.—An Overseer and Collector's house, a store-house, and Lockman's shed.

At each of the intermediate Locks.—A house for a Munshee as Collector, a store-house, and Lockman's shed.

Eight Chowkies on line for Muccadums.

Abstract.

Locality.	Items.	Rs.	A.	P.
At Kurrachee.	An Overseer's and Collector's house at basin	1,200	0	0
	A storehouse for tools, &c., and work-shop	1,600	0	0
	Fittings for above	1,000	0	0
	Lockman's shed	100	0	0
At Jerruck	An Overseer's and Collector's house at head	1,000	0	0
	Store-house and work-shop	2,500	0	0
	Fittings, &c.	1,500	0	0
	Lockman's shed	100	0	0
Intermediate Locks	Munshee Collectors' houses, at Rs. 200	600	0	0
	Lockmen's sheds, at Rs. 80 each	240	0	0
	Store-houses for tools, at Rs. 350 each	1,050	0	0
	Eight chowkies throughout the line, at Rs. 50 each	400	0	0
		11,290	0	0
	5 per cent. contingencies	564	8	0
	Amount for buildings, &c. Rs.	11,854	8	0

General Recapitulation.

Items.				Rs.	A.	P.
Cuttings	Rs.	12,53,581	3	6		
Embankments		6,15,115	12	8		
Pise work		4,82,530	8	4		
Contingencies, &c.		1,17,561	6	0		
Total earthwork					24,68,788	14	6
Regulation lock at head					1,05,839	15	2
Dam and escape-weir					55,644	12	4
Aqueducts					12,54,750	0	0
Small locks					79,891	8	2
Syphon drains					1,61,926	10	4
Outlets and inlets					89,414	0	4
Culverts, &c.					1,99,165	13	8
Road bridges					59,320	15	6
Buildings					11,854	8	0
					44,86,597	2	0
The cut to harbour					3,64,175	15	0
Grand total of estimate				Rs.	48,50,773	0	0

Company's Rupees Forty-eight lakhs, Fifty thousand, Seven hundred and Seventy-three.

H. B. TURNER, Major,
Superintending Engineer.

W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, November 1st, 1853.

RAILROAD REPORT.

General Remarks.

A cursory inspection of the map of Scinde, and a slight knowledge of the commercial routes of the province, are requisite to determine on the valley of the Indus as the *direction* that any contemplated railroad must of necessity take; and since the unequivocal success which attended the construction of the first line of railroad in England is universally attributed to a complete communication having been *at once* established between two important points, while the wisdom of the principle laid down has been so fully borne out, as well by the failures as successes of subsequent undertakings, as to have become almost an axiom in railway considerations, no further argument appears necessary to demonstrate the advisability of at once connecting the two most considerable places in the general line of communication desired.

The point to be connected with Kurrachee.

2. In ascending the valley of the Indus, the first point of political and commercial importance presenting itself, on the right bank of the river, is Kotree; and as a railroad with its terminus here would fully satisfy the requirements of a direct communication with the Indus, which forms the subject of this Report, it appears advisable that Kotree, the port of Hyderabad, should be at once connected with Kurrachee, the harbour of Scinde.

The importance of Kotree and Kurrachee.

The latter derives its consequence from being the head quarters of the Civil government and Military establishments of the province, in addition to being a rising sea-port, dependent only upon the improvement of its harbour for European commercial importance; while the former, in addition to its immediate proximity to the large station of Hyderabad, and being itself the depôt of the Indus Flotilla, presents also, in conjunction with Hyderabad, a centre, to which all the great lines of traffic from Upper and Lower Scinde, Southern Rajpootana, and Cutch, severally converge; whilst its position on the Indus adds to these the additional advantages of intercepting the down river traffic before the navigation becomes difficult and attended with risk.

Capability of extension.

3. As the only other important preliminary consideration necessary to be noticed, *i. e.* that of capability of extension along the valley of the Indus, is answered by the position of Kotree, little doubt appears to exist as to the advisability of selecting Kotree, (or, as will be hereafter explained, a spot near it,) and Kurrachee, as the termini of the first railway to be constructed in Scinde, provided it can be shown that no financial objections exist.

Practical objections to Kotree as a Terminus

4. There are, however, two practical disadvantages to Kotree as a terminus to a railroad, which require full consideration—the one arising from the doubtful stability of the river bank above the town, (*vide* Captain Ethersey's letter, Appendix A,) and the other existing in the outlay which would be required to bridge the Bharun, a large broad river, with an uncertain sandy bed, which, in freshes, brings down an immense volume of water.

5. The first objection, I am inclined to believe, may readily be overcome

by locating the railway terminus on some hard rising ground about 1½ mile to the SW. of Kotree, and then connecting it with the town and river, either by a branch line of rails, or by canal, as circumstances may show to be expedient.

The second objection, being a mere matter of expenditure, its weight may be at once determined by a comparison of the pecuniary advantages resulting from the adoption or rejection of the extension beyond Jerruck.

disposed of for the present.

6. As neither point, however, will materially affect the general consideration of the railway, on which only this Report enters, the settlement of both may be advantageously postponed until the local knowledge acquired from detailed surveys, and the necessary calculations, shall have furnished data for arriving at satisfactory conclusions.

Line from Kurrachee to Kotree.

7. In the mean time, for the purpose of examining the project, I shall suppose that the line from Kurrachee to Kotree has been selected upon the general principles already submitted.

General Remarks.

8. My time having been fully occupied during last season with the canal project, I was unable to lay down a line for a railway, or to take any levels with a view to determining its gradients; still I have collected sufficient information to enable me to give a general opinion as to the cost of constructing a railroad from Kurrachee to Kotree, and to form a judgment as to whether the undertaking may be expected to be remunerative, or otherwise, with the present amount of traffic.

9. The considerations brought forward, though doubtless imperfect, from their not entering sufficiently into detail, will still afford ample data to enable a conclusion to be drawn by Government as to the respective advantages of a canal and railroad. Should the first project be approved, it could at once be carried out on the estimate now submitted; and should the second be preferred, the approaching season would probably suffice for the survey and estimate of the details of its construction.

Facility offered by the Country.

10. That the flat country of Lower Scinde is most favourable to the introduction of a railroad will be evident from an inspection of the sections of the canal, in which work, though the line was necessarily restricted to a series of dead levels, neither cuttings nor embankments are proportionably great.

11. The railroad, by reason of admission of inclines into its construction, will be enabled to take a more direct route than the canal through the hills to Kotree, and, with its branch to Kotree, will probably extend to 110 miles in length.

Estimate; remarks.

12. The following estimate is drawn out in accordance with the general principles laid down in the Most Noble the Governor General's Minute on Railroads. The guage has been fixed at 4′ 8½″, as being that now by common consent most generally adopted; and the rail proposed is that of the ordinary ⨏ shape, with fished joints, and weighing 70 lbs. to the yard, as being of the simplest form in use, and sufficiently heavy for the expected traffic. For sleepers, I propose using the red heart of the babool wood from the Scinde forests. An extract of a letter from the Forest Ranger, in reply to my inquiries as to its durability and cost, will be found in Appendix B.

Rough Estimate of the probable Cost of constructing a Mile of Railway between Kurrachee and Kotree on the Indus.

The line to be formed with a single track, with bridges and embankments corresponding, but the foundations in extension bridges, or in difficult cases, to be at once built to suit a double line of rails.

	Rs.	a.	p.	Rs.	a.	p.
Earth Works, calculated at a mean depth of cutting in embankments of 4 feet formation, level roadway 18 feet broad, slopes 2 to 1 ; or 549,120 cubic feet, at 6 annas per 100 cubic feet	2,059	0	0			
Bridges and Culverts, not including Mullear or Bharun rivers, inclusive of foot bridges and level crossings..	3,800	0	0			
Walling, Fencing, and Drainage of embankments and cuttings	500	0	0			
Turn-tables, Switches, Crossings, &c.	900	0	0			
Water Tanks, Cranes, Pumps, &c.	1,200	0	0			
Signal Posts, &c.	150	0	0			
Total.. Rs.	8,609	0	0			
PERMANENT WAY.						
Ballasting, 126,720 cubic feet, at Rs. 3 per 100 c. ft.	3,802	0	0			
Sleepers, 1,760, of Scinde babool wood, none but the red heart of the wood being used, at Rs. 2¼ each (10 feet long × 8″ × 5″)	3,960	0	0			
Spikes, 8,000, at 1 lb. each, or 3½ tons, about, at £12 per ton..	420	0	0			
Chairs, all intermediates of 25 lbs. each ; 3,520, weight 40 tons, about, at £7 per ton..	2,800	0	0			
Rails, 70 lbs. per yd. fished joints, 110 tons, at £9 per ton..	9,900	0	0			
Add one-tenth for sidings and station rails	990	0	0			
Laying Rails, (including keys of compressed wood, valued at £8 per 1,000,) at Rs. 2 per lineal yard ..	3,520	0	0			
Total permanent way per mile .. Rs.	25,392	0	0			
As above	8,609	0	0			
Cost of construction per mile .. .. .. Rs.	34,001	0	0			
Cost of 110 miles, from Kurrachee to Kotree .. Rs.	37,40,110	0	0			
Add—						
For Mullear river bridge	2,00,000	0	0			
For Bharun river bridge.	3,00,000	0	0			
Total cost of construction from Kurrachee to Kotree. Rs.				42,40,110	0	0
ROLLING STOCK FOR 110 MILES.						
10 locomotive engines, with tenders, with duplicates of working and wearing parts, from 10 to 14 tons weight, at £2,000 each	2,00,000	0	0			
6 first class passenger carriages, at £300 each ..	18,000	0	0			
6 second class do. do., at £220 each	13,200	0	0			
20 third class do. do. at £150 each	30,000	0	0			
6 horse boxes, at Rs. 1,200 each	7,200	0	0			
150 goods waggons, at Rs. 1,000 each	1,50,000	0	0			
10 cattle cages, at Rs. 1,000 each	10,000	0	0			
20 coal waggons, at Rs. 560 each	11,200	0	0			
4 luggage vans, at Rs. 1,200 each	4,800	0	0			
Total rolling stock				4,44,400	0	0
Freight and carriage, &c...				80,000	0	0
Carried forward .. .. Rs.				47,64,510	0	0

			Rs.	a.	p.
Brought forward			47,64,510	0	0
Buildings and Stations.					
Total	Rs.	2,50,000			
Lathes, tools, Furniture, &c. fittings for do. ..		68,000			
Total buildings and stations ..			3,18,000	0	0
Grand Total	Rs.		50,82,510	0	0

Recapitulation,

Showing the probable Cost of each (as estimated) General Item in the Construction and Stocking of a Railroad from Kurrachee to Kotree on the Indus.

Items.		Cost for whole length, 110 Miles.		
		Rs.	A.	P.
Earth works		2,26,490	0	0
Bridge over Mullear River		2,00,000	0	0
Ditto over Bharun River		3,00,000	0	0
Remaining bridges and culverts		4,18,000	0	0
Walling, fencing, and drainage		55,000	0	0
Turn-tables, switches, crossings, &c.		99,000	0	0
Water tanks, cranes, pumps, &c.		1,32,000	0	0
Signal posts, &c.		16,500	0	0
Permanent Way.				
Ballasting.	4,18,220			
Sleepers	4,35,600			
Spikes	46,200			
Chairs	3,08,000			
Rails	11,97,900			
Laying rails	3,87,200			
Total		27,93,120	0	0
Rolling stock		4,44,400	0	0
Freight and carriage		80,000	0	0
Buildings and stations		3,18,000	0	0
		50,82,510	0	0
Contingencies and establishment at 10 per cent.. ..		5,82,251	0	0
Grand total of estimate	Rs.	56,64,761	0	0

Amount of Estimate.

13. The total estimated amount of a railroad from Kurrachee to Kotree is therefore Rupees Fifty-six Lakhs, Sixty-four thousand, Seven hundred and Sixty-one.

14. Not including the two large rivers, *i. e.* the Mullear and Bharun, the probable cost per mile amounts to Rs. 46,952·3; but inclusive of these, the rate per mile is estimated at Rs. 51,497·8, which provides for working stock, buildings, and all necessaries for the commencement of the working of the line.

Traffic.

15. The amount of traffic which will probably be brought upon the railroad, and the returns which may be consequently expected, contrasted with the working expenditure, for the purpose of determining what interest may reasonably be looked for on the capital required, are now the points for consideration.

16. From the position of Kurrachee with respect to the Indus, the traffic naturally classifies itself under two divisions:—

1*st*, the traffic by river.

2*nd*, the traffic by land.

Each of these, again, resolves itself into two heads:—

1*st*, the traffic carried on by Native river craft.

2*nd*, that conveyed by the steamers of the Indus Flotilla.

And again:—

1*st*, the traffic by the main road through Tatta and Jerruck to Kotree.

2*nd*, that existing on several direct routes through the hills, varying in extent, as the supplies of water and forage are scarce or abundant.

Under these heads the goods traffic must first be considered.

River Traffic; Native Craft.

17. To enable a judgment to be formed of the amount under the first head, a return (Appendix C) of the exports and imports of the different ports of the Indus, furnished by the Collector of Customs, is available, from which it will be seen, that the river traffic by Native craft is estimated at 30,406 tons.

18. A slight check upon this amount is derivable from a register, kept by the authorities of the Indus Flotilla, of the number of boats passing different stations of the river (vide Appendix to Canal B), from which an approximation to the maundage of goods passing Tatta, (which only, for reasons given in the Canal Report, can be safely taken,) is calculated at 15,46,600 maunds. Reducing this by one-third, as an allowance for vessels being imperfectly filled, it gives a tonnage of 55,236 tons, which is no doubt exaggerated, but so far valuable as to show that the first estimate, which must be taken as representing the river traffic, is probably on the safe side.

Indus Flotilla.

19. The quantities of goods and merchandize, both Government and private, conveyed by the Indus Flotilla, are shown in the accompanying returns, (Appendices D and E,) furnished by Captain Ethersey. The first item, Government stores, amounted from the 1st February 1848 to 30th April 1853, or during the course of 62 months, to 10,936 tons. The proportion of this for one year is 2,117 tons. Private merchandize, again, conveyed from the 1st May 1851 to the 30th April 1853, was 23,622 maunds. The half of this for one year amounts to 422 tons. The tonnage under this head may consequently be set down at 2,539 tons per annum.

Overland Traffic.

20. The overland routes, divided into, 1*st*, the traffic by the main road by Tatta and Jerruck; 2*nd*, by the various hill routes.

21. In considering this branch of the traffic, the returns furnished by the Police Authorities constitute the only official documents available: though imperfect for the purpose, still some approximation may be deduced from them, upon which an estimate of the probable amount of traffic may be based.

22. These returns (vide Appendix F) are taken at four places on the high road between Kurrachee and Hyderabad: two of these, *i. e.* those at Gharra and Tatta, the central stations, cannot clearly be taken as representing the *through* traffic, on account of the registers at Jemedar-ke-Landi and Jerruck, the outer stations, showing a great decrease in almost every item. The great difference observable may be accounted for, in the instance of Tatta, by its being a large city, and consequently subject to great local movement; and in the case of Gharra, by a much frequented cross-communication from the Sakra Purgunna passing through it, as well as from its neighbourhood being a favourite grazing-ground for camels, of which animals a large number is shown in its register.

To assume the returns of Jemedar-ke-Landi, would be to suppose that everything passing through that place continued on to Kotree, which would manifestly lead to error.

23. The mean between the returns of Jemedar-ke-Landi and Jerruck must, therefore, be taken to represent the *through* traffic between Kurrachee and Kotree, on this road.

24. As the returns do not distinguish between laden and unladen, the usual proportion of two-thirds to one-third will be taken for all descriptions of conveyance. The abstract statement attached to the Police Returns (Appendix F) shows the calculation, agreeably to the above considerations; and the amount, 1,571 tons, must be supposed to represent the overland traffic by this route.

But a correction is still required for the various routes mentioned under the second head of this division, for which no register of any description exists.

This is supplied by a return furnished me by the Captain of Police, from inquiries made of all the principal merchants of the town, and by written statements received from those of Camp, including, in all instances, the entire trade of their firms by the land route (vide Appendix G). From an abstract of these statements, also annexed, in which the necessary deductions are made in certain cases, it will be seen that 3,792 tons are deduced.

25. In order to apply this correction, it will be necessary to take the mean of the two estimates, or 2,681 tons, as the total amount of traffic to be calculated upon the land route from Kurrachee through to Kotree.

26. The entire present traffic in goods and merchandize which would be carried by a railroad would therefore be as follows:—

By river...	Native Craft	30,406 tons.
	Indus Flotilla	2,539 „
By the land routes		2,681 „
	Total	35,626 tons.

Further Check on Total Traffic.

27. As a check upon this total, again, the Collector of Customs, in a return furnished by him of the exports and imports by the sea face (vide remarks on Appendix H), after making deductions,—1*st*, for the consumption at Kurrachee; 2*nd*, for the imports and exports across the western frontier; and 3*rd*, for the partial lading of vessels,—estimates the probable amount of exports and imports of the land face, both by the direct routes and by the river, at 57,050 tons.

28. Considering, then, the sources from which the totals of the above summary have been derived, and the authority which supports the last estimated amount, it appears to me that 40,000 tons may be very safely assumed as the smallest amount of goods which will probably be carried over its entire length each year by a railroad.

Ordnance and Commissariat Stores.

N. B.—All stores forwarded by the Commissariat and Ordnance Departments are transmitted through the agency of the Indus Flotilla (vide Appendices I and K), and are consequently included in the returns furnished by the Superintendent.

Passenger Traffic; General Remarks.

29. Before proceeding to the consideration of the amount of passenger traffic that may be expected upon a railway, I would quote an extract from a letter from Captain Crawford, the Superintending Engineer Railway Department, Bombay, on this head, which, though of the greatest importance at home, has not always been allowed a place in railway calculations in India,

an omission arising from a general conviction that Natives would be slow to take advantage of a new means of locomotion supposed to be incompatible with their present habits, and, in fact, much beyond their appreciation.

Captain Crawford, in speaking of the experimental line at Bombay more than three months after its opening, when the novelty must to a certain degree have worn off, says: "It answers well, and conveys a regular traffic, even during the monsoon, of some 5,000 passengers a week, and considerably more than pays its own expenses. All classes use it—men, women and children; and the poorest avail themselves of it in travelling on business, which is a good sign for the further extension."

30. This testimony, supported by the combined reports of the different Presidency journals, appears a sufficient authority for believing that passenger traffic in India, provided the fares are low, will form a very important item in railway returns, and that taking into account the marvellous increase of movement which has always followed the introduction of railroads, it fully warrants the assumption that at least one-third of the number of passengers at present found on any line of road affected are likely to avail themselves of the new means of transport.

Passenger Traffic.

31. Suppose this to be admitted, the following passengers may be expected on the line:—

		Per Annum.
1st Class, say		600
2nd Class, say		1,200
3rd Class, the mean of the Police Return of Jemedar-ke-Landi and Kotree, taking one-third (vide Appendix F)	11,342	
Troops, the average of five years (vide Deputy Assistant Quarter Master General's Return, Appendix to Estimate L)	9,300	
Total 3rd Class		20,642
4th Class, servants and camp followers for above, 2 to each ..		18,600

Reference to Estimate; Working Expenses.

32. The following comparative estimate of working expenses and returns will show the surplus available for a dividend on the capital required for the construction of the railroad.

Fares.

33. The rate per ton per mile at which goods are calculated is judged to be reasonable, on a consideration of the present cost of carriage in Lower Scinde, from inquiries made in various quarters, a statement of the results of which will be found in Appendix M.

34. The scale of passenger fares is for the 1st class about that in use in England, but by the introduction of a 4th class, at 2 pie per mile, the railroad becomes available to the very poorest labourer, whose fare, supposing him to travel from Kurrachee to Hyderabad, would be Rs. 1-2-0, an expenditure which would be fully made up to him by his labour and saving of food during the time gained.

35. *Estimate of the probable Working Expenses and Returns of a Line of Railroad between Kurrachee and Kotree—Length* 110 *Miles; probable Traffic Goods* 40,000 *Tons.*

Expenditure.	*Rs.*	*a.*	*p.*
By maintenance of way, at Rs. 600 per mile, for 110 miles.	66,000	0	0
Ditto ditto of masonry works and buildings, at 1 per cent. on cost	12,360	0	0
Carried forward	78,360	0	0

	Rs.	a.	p.
Brought forward	78,360	0	0
Locomotive Expenses.			
One train each way daily, for the conveyance of passengers, the post, and light goods; and one train for heavy goods each way every alternate day; or 120,450 mileage, at 8 annas	60,225	0	0
General charges, police and establishment	60,000	0	0
Rs.	1,98,585	0	0

RECEIPTS.

From 40,000 tons of traffic over 110 miles, at 1 anna per ton per mile	2,75,000	0	0
600 passengers, 1st Class, at 2 annas per mile ..	8,250	0	0
1,200 ditto, 2nd Class, at 1 anna per mile ..	8,250	0	0
11,342 ditto, 3rd Class, at 6 pie per mile.. ..	38,988	0	0
9,300 Troops, at 6 pie per mile	31,968	12	0
18,600 Camp Followers, 4th Class, at 2 pie per mile..	21,312	8	0
The yearly expenses of two Indus steamers dispensed with (vide Captain Ethersey's letter, Appendix A) ..	75,000	0	0
The yearly cost of dawk contract (vide Post Master's letter, Appendix O)	24,000	0	0
Rs.	4,82,769	4	0

Amount available for Dividend.

36. The surplus of the income over the expenditure is, therefore, Rs. 2,84,184, which would provide for a dividend of upwards of 5 per cent. on the estimated capital required.

Probable increase of Traffic.

37. In the above calculations no credit is taken for the great increase of the trade of the port, which is stated by the Collector of Customs (vide his letter, Appendix H,) to have steadily augmented "for several years past at the rate of 20 per cent. per annum," and which bids fair to show a greater proportional increase for the future, from the desire evinced by the Comissariat authorities to take advantage of the Indus route in providing European necessaries to the Troops in the Upper Provinces and the Punjab.

38. As an experiment, 10,000 casks of ale and porter, during the present year alone, have been forwarded from England direct to Kurrachee, for transmission by the Indus. Should this not answer as an economical arrangement, from the serious drawbacks existing in the navigation of the tidal channels, and lower part of the river, a railroad, removing all these obstacles, could not fail to have the effect of turning the scale in favour of the route, and a considerable traffic would be opened out in the conveyance of Government stores alone, to the no small benefit of Government itself.

Further Saving.

39. In common with a canal, the railroad would effect much saving to Government in the wear and tear of camp equipage, and marching kit, as well as in avoiding damage from exposure and delay to perishable articles, such as the European stores above alluded to.

It would also, provided, as must necessarily be the case, it were connected with the harbour, either by a cut to its terminus, or by extending a line of rails to the shipping, assist in effecting a very great saving in the local expenses of the Commissariat Department.

Returns really under-estimated.

40. In assuming no greater a return than 5 per cent. as the least dividend a railroad may be fairly expected to yield, when, as will be evident

throughout the calculations, I might have availed myself of the elasticity of facts and probabilities, which both practice and the ripe experience of railroad statistics would fully justify, to augment considerably the profits, I have been guided by a desire merely to show that the project would in itself *pay*; but this desire need not prevent my expressing a conviction, that, provided the Company undertaking its construction can be prevailed upon to do away with the unnecessary and expensive addition of a Board of Directors in England, substituting Agents and Auditors only, and placing confidence in the superintendence of the local Government and Direction, a railroad from Kurrachee to Kotree will prove a most remunerative speculation.

Comparison of Canal & Railroad.

41. It now remains only to place the two projects in contrast—1*st*, as regards expenditure and returns, so far as they have been considered; and 2*nd*, with reference to the advantages offered by each.

1*st*.—The estimated cost of the two projects, with their probable return, are as below:—

	Cost.	Return on Capital.
Canal.....	Rs. 48,50,773	4 per cent.
Railroad	56,64,761	5 per cent.

In this comparison the railroad apparently holds out the greatest promise.

Remarks on Canal.

2*nd*.—In the matter of indirect advantages, the supply of water which the canal would ensure to Kurrachee and its neighbourhood cannot be overrated, and were it possible to guarantee the execution and unopposed continuance of *one scheme only*, this great benefit, considering the other facilities it affords, would in my opinion be a sufficient reason for deciding in its favour. But in the present age of progress, nothing in any way behind the onward spirit of the times can, I am afraid, be contemplated, and we have a case in point in the supercession of the Mahmoudie Canal, the warning held out by which must, I fear, be held fatal to a similar project here.

Remarks on Railroad.

42. It appears unnecessary to dwell upon the advantages, political, commercial, and social, which have invariably followed the introduction of railroads in all parts of the world, and which I cannot but think are to be equally claimed for India, where British enterprise would still lead the way; nor need arguments be adduced to prove that India is in a position, from the immense capability which she possesses in her wide-spreading fertile plains for the growth of surplus produce, to take a prominent position among countries exporting raw materials and grain, provided only the means of transporting these staple sources of wealth to her numerous ports were adequately provided.

Great want of Means of Communication in Scinde.

43. Scinde in itself is a crying proof of this prevailing want. Here, on account of the scarcity of a coined medium, a great portion of the Government revenue is annually paid in kind; and I have heard upon good authority, that it is not uncommon, in seasons more than usually abundant, to see masses of grain, which under other circumstances might possibly have been the means of mitigating in a distant part the horrors of famine, lying rotting on the ground. This necessity is further exemplified, in the case of the province, by the great disproportion which exists in the price of grain in the producing and consuming districts, as seen in the weekly tariffs, (vide Appendix and Remarks N,) evincing an absence of the necessary means for regulating market prices, and rendering apparent the existence of a monopoly in the supply of the necessaries of life, which cannot but act prejudicially in any place or state of society.

Concluding Remarks.

44. A conviction of the general importance of Scinde as a commercial acquisition has so grown upon me during the course of the inquiries on which I have been engaged, that I cannot close this Report, especially since the examination shows that no financial objection exists to either project, without respectfully urging, through you, upon Government, the advisability of at once securing to the province and Upper India the manifold benefits which the adoption of either scheme, preferably doubtless the latter, is unquestionably calculated to bestow; and I would conclude by trusting that the statistical information collated and embodied in the documents now submitted will in some measure excuse the length to which this Report has necessarily been extended.

I have the honour to be,

Sir,

Your most obedient Servant,

W. CHAPMAN, Lieutenant, Engineers,

On Special Duty, Scinde.

Kurrachee, November 1st, 1853.

(True copy)

W. CHAPMAN, Lieutenant,

Engineers.

APPENDIX A.

No. 584 of 1853.

From Captain R. ETHERSEY, I. N.,
Commanding Indus Flotilla,

To Lieutenant CHAPMAN, Engineers,
On Special Duty, Scinde.

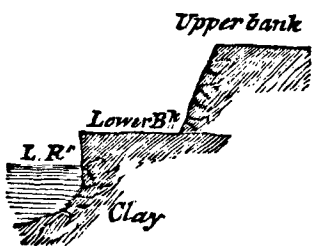
Dated Kotree, 23rd June 1853.

Sir,

I have now the pleasure to forward the several returns called for in your letter dated the 9th ultimo, which has been a work of much time and labour.

2. A return of the number of laden and unladen boats of all descriptions which have passed this place for the last two years can be obtained from the Commissioner.

3. With regard to the merits of Kotree and Jerruck as points for the terminus of a railway, the latter has this one advantage, viz. it may be considered a permanent point, whereas Kotree cannot; nevertheless, for eleven years, the bank here has undergone little or no alteration: it has during that period remained steep, with deep water close to it. Immediately above this, however, the river has considerably altered the upper bank. The inundation of 1850 commenced, and subsequent ones have continued, to wash it away to a considerable extent: this it will not be a difficult matter to stop, for should the bandalls, which have been re-erected this year, fail in their object, there is abundance of rubble stone available within a mile of the bank, than which nothing appears to answer better in protecting a bank (formed as it is above Kotree) from the effects of a strong stream; and so long as this can be done, there is no probability of the river forcing its passage in the rear, for the lower bank in this vicinity consists of a yellowish clay, on which the stream has little or no effect, so that when the inundation subsides the river retires into its old channel.



4. But if, after all, the bank at Kotree be objected to as a terminus, from doubts of its permanency, the advantages of position are so great, as affording direct communication between Kurrachee and a large town, arsenal, and Military station like Hydrabad, that some spot should be selected in its vicinity for a terminus, connected with the river by a tram-way or other means.

5. For this purpose, the hard stony ground 1½ mile SW. from this offers an excellent site.

6. If a railroad be completed to Kotree, the working of the Flotilla could be confined above this, and the services of three steamers dispensed with, the working expenses of which amount to about Rs. 75,000 per annum.

I have the honour to be, Sir,
Your most obedient Servant,
(Signed) R. ETHERSEY, Captain I. N.,
Commanding Indus Flotilla.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

APPENDIX B.

No. 189 of 1853.

From the FOREST RANGER IN SCINDE,
On Circuit,

To Lieutenant CHAPMAN,
Engineer Department,
On Special Duty, Scinde.

Dated 16th May 1853.

Sir,

In reply to your letter No. 31, of the 9th instant, I have the honour to inform you, that I have not sufficient knowledge of babool timber to enable me to give satisfactory replies to your questions, with the exception of the last, regarding the cost at which timber for sleepers can be supplied.

2. In reply to question No. 1, I beg to state, that I applied for, and have received the Commissioner's sanction to exporting babool timber from Scinde as a trial, a proof that I consider it worthy of exportation; but the only way in which I would expect the value of the Scinde Forests to be increased, by the means of transport afforded by a railway, would be by the consumption of timber in Kurrachee.

3. During my stay in Kurrachee last rains, the Executive Engineer showed me a block of babool which had lain in the timber-yard for some years, and he stated, that if he could obtain such timber in Kurrachee, he would prefer it, for many purposes, to the best teak-wood.

4. The white-ants had attempted to eat the log of babool, and had made an impression on the white part or sap-wood, but had not been able even to mark the red wood, and no means had been adopted to preserve it against their attacks.

5. Although I cannot give any information as to the difference between it and the Deckan babool, I have no hesitation in stating, that the *red* part, or heart of the Scinde babool, is *not* liable to destruction by white-ants, when seasoned.

6. Before it is seasoned, babool is decidedly liable to destruction by white-ants, especially the white part, but the red heart generally resists their attacks well, even when exposed in the green state.

7. The red babool of Scinde, from the density of its fibre, and its lasting properties, is particularly suited, in my opinion, for railway sleepers.

8. After it is well seasoned, say for nearly two years, nothing is required to preserve the red babool from dry-rot, or the attacks of white-ants.

9. If used before it is perfectly seasoned, I would recommend the simple and cheap process of giving a coating of tar to the babool, to protect it against the influence of water, and that only the *red wood* should be used.

10. If your Department will be at the expense of felling and removing the timber, and will lay no claim to the cuttings or chips therefrom, removed in the dressing, but will allow them to be disposed of by the Forest Department, you may *choose* timber

from the forests, taking only the red wood for sleepers, by paying at the rate of Rs. 1 for each sleeper 8 feet in length $\times 10'' \times 6''$; or, if you will cause the timber to be dressed by the saw, instead of the hatchet, and allow the Forest Department to have the disposal of the planks, you may have the sleepers at Rs. 15 per score.

11. According to the above terms, no discount or deduction will be allowed on your bills.

12. You will be better able than I to form an estimate of the expense of cutting and conveying the sleepers from the forests.

13. The larger and older the trees from which the timber be taken, the better properties will it possess, and the less wastage of sap-wood will there be.

14. I would recommend trees not less than 4 feet in girth, from which 2 sleepers could be sawn.

15. Timbers may be sawn at the rate of Rs. 2 per hundred square feet, and pieces $8' \times 12'' \times 10''$ might be removed to the line of railway, leaving the cuttings in the forest.

16. I append a list of the forests from which timber may be had for your purpose, with their situation, &c.

17. Garkah forest, the lowest down, near Peer Puttah, is not easily accessible by land, except from Tatta, from which it is distant 9 or 10 miles; but it is on the bank of the Bigar, by which, in the monsoon, timber can be conveyed in boats to Whagoodhur Bunder, 14 miles from Kurrachee, and about 3 miles from Jemedar-ke-Landi.

18. The next forest, proceeding upwards, is Shah Loonkah Beylah, near which the road passes, 4 miles above Tatta.

19. Adjoining Shah Loonkah is Lullung forest, which joins with Heliyah forest, of which the lower part only contains babool timber.

20. The upper part of Heliyah forest consists principally of jungle wood.

21. Above Heliyah there is a distance of 8 miles without timber, to Toondah forest, close to which the road runs for about half a mile.

22. In Toondah forest are good old babool trees, suitable for cutting into sleepers.

23. From Toondah, there is a good hard road for about 6 miles, to Veeran forest, which is about 2 miles below Jerruck.

24. In Veeran Beylah are old red babool trees.

25. The lower part of Karikah forest is about 14 miles above Jerruck, on the river bank, and is a narrow strip of fine old babool trees, extending towards Kotree, for about 5 miles. Its upper end is 3 miles below Kotree.

26. The best timber is to be had from trees measuring from 4 to $4\frac{1}{2}$ feet in girth.

27. Many of the trees above 5 feet in circumference are unsound; and, generally speaking, the Scinde babool does not grow healthily much above 5 feet in circumference; though some healthy trees may be found measuring as much as 12 or 13 feet in girth.

I have the honour to be, Sir,
Your most obedient Servant,
(Signed) R. W. BAYNE, Assistant Surgeon,
Forest Ranger in Scinde.

Bunnhur, Ranger's Office, 16th May 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

List of Babool Forests on the Right Bank of the Indus, below Kotrce.

Names.	Remarks.
Karikah	Commences 3 miles below Kotree, and extends along the river bank for 5 miles.
Veeran	On the river bank, 2 miles below Jerruck.
Toondah	6 miles below Veeran.
Heliyah	8 miles below Toondah.
Lullung	Joins with Heliyah forest, and extends about 2 miles.
Shah Loonkah..	Extends for about 3 miles above Chuttun-ka-Gainn, 4 miles above Tatta.
Garkah	Is 9 or 10 miles below Tatta, on the Bigar, and is not near the Kurrachee road.

(Signed) R. W. BAYNE, Assistant Surgeon,
Forest Ranger in Scinde.

Bunnhur, Ranger's Office, 16th May 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

APPENDIX C.

Statement of Imports and Exports, also the Tonnage employed in conveying Merchandize, and the Amount of Freight paid thereon, from May 1850 *to April* 1851.

	Imports from	Exports to	On Import, No. of Tons employed in conveying Merchandize, and the Amount of Freight paid thereon.		On Export, No. of Tons employed in conveying Merchandize, and the Amount of Freight paid thereon.		Number of Days occupied in Upward Trip.		Number of Days occupied in Downward Trip.	
			Number of Tons.	Amount of Freight.	Number of Tons.	Amount of Freight.	Fair Season.	Cold Season.	Fair Season.	Cold Season.
	Rs. A. P.	Rs. A. P.		Rs. A. P.		Rs. A. P.				
Tatta	7,500 0 0	8,585 0 0	280	227 8 0	368	185 0 0	2 days.	5 days.	1½ days.	4 days.
Jerruck	7,125 12 0	551 8 0	333	231 4 0	98	29 12 0	3 „	7 „	2¼ „	6 „
Kotree	1,965 0 0	22,159 10 6	112	101 8 0	84	63 8 0	4 „	10 „	3 „	9 „
Hyderabad	2,69,740 4 0	1,39,188 10 0	7,366	6,859 6 0	3,624	1,810 12 0	4 „	10 „	3 „	9 „
Muttara	31,952 8 0	3,954 2 0	1,145	823 8 0	630	195 6 0	5 „	11 „	5 „	10 „
Gotannah..	1,87,942 10 0	67,211 8 0	6,870	6,448 14 0	362	1,723 4 0	6 „	13 „	5 „	11 „
Mazendah	29,635 12 0	1,664 12 0	1,141	895 12 0	568	339 0 0	7 „	14 „	7 „	13 „
Sehwan	11,135 13 0	883 12 0	486	726 7 0	104	56 12 0	8 „	16 „	9 „	14 „
Larkhana..	32,381 12 0	112 0 0	1,181	2,338 0 0	16	24 8 0	14 „	40 „	11 „	38 „
Sukkur	2,32,075 4 0	2,35,863 14 0	3,314	5,929 0 0	4,554	7,844 4 0	15 „	45 „	12 „	40 „
Shikarpore	5,169 4 0	.....	126	186 0 0	....	.....	16 „	48 „	15 „	45 „
	8,16,623 15 0	4,80,174 12 6	22,354	24,767 3 0	10,480	12,272 4 0	84 days.	219 days.	73¾ days.	199 days.

Khettie Custom House, 3rd June 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

(Signed) M. M. D'ABREO,
Clerk in Charge.

Statement of Imports and Exports, also the Tonnage employed in conveying Merchandize, and the Amount of Freight paid thereon, from May 1851 to April 1852.

	Imports from	Exports to	On Import, No. of Tons employed in conveying Merchandize, and the Amount of Freight paid thereon.		On Export, No. of Tons employed in conveying Merchandize, and the Amount of Freight paid thereon.		Number of Days occupied in Upward Trip.		Number of Days occupied in Downward Trip.	
			Number of Tons.	Amount of Freight.	Number of Tons.	Amount of Freight.	Fair Season.	Cold Season.	Fair Season.	Cold Season.
	Rs. A. P.	Rs. A. P.		Rs. A. P.		Rs. A. P.				
Tatta	3,362 5 0	7,613 4 0	117	67 13 0	254	130 4 0	2 days.	5 days.	1½ days.	4 days.
Jerruck	2,156 8 0	187 13 0	68	39 0 0	66	35 12 0	3 „	7 „	2¼ „	6 „
Kotree	2,250 8 0	15,070 0 0	112	101 8 0	24	26 0 0	4 „	10 „	3 „	9 „
Hyderabad	90,391 0 0	2,09,267 5 6	3,385	2,690 10 0	3,074	2,131 12 0	4 „	10 „	3 „	9 „
Muttara	24,231 8 0	3,815 0 0	879	480 12 0	594	195 12 0	5 „	11 „	5 „	10 „
Gotannah	1,76,866 8 0	37,775 8 0	6,664	5,404 13 0	3,132	1,618 12 0	6 „	13 „	5 „	11 „
Mazendah	10,715 8 0	1,567 0 0	452	395 4 0	608	371 0 0	7 „	14 „	7 „	13 „
Sehwan	16,796 0 0	7,847 0 0	736	1,237 8 0	352	270 8 0	8 „	16 „	9 „	14 „
Larkhana	4,664 0 0	1,457 0 0	73	242 8 0	34	38 8 0	14 „	40 „	11 „	28 „
Sukkur	5,40,268 8 0	4,07,871 13 8	6,398	12,484 0 0	3,360	5,768 11 0	15 „	45 „	12 „	40 „
Shikarpore	3,211 0 0	.....	24	56 6 0	....	.....	16 „	48 „	15 „	45 „
	8,74,913 5 0	6,92,471 12 2	18,908	23,200 2 0	11,498	10,586 15 0	84 days.	219 days.	73¾ days.	199 days.

Khettie Custom House, 3rd June 1853.

(True copy)
(Signed) J. MACLEOD,
Deputy Collector.

(Signed) M. M. D'ABREO,
Clerk in Charge.

No. 122 of 1853.

To JOHN MACLEOD, Esq.,
Collector of Customs,
Kurrachee.

Sir,

In acknowledging the receipt of your endorsement No. 232, dated 24th ultimo, giving cover to copy of a letter from Lieutenant Chapman, of the Engineers, on special duty in Scinde, I do myself the honour to furnish such data as is available in the Department relating to the river traffic. This has been embodied in the annexed statements, drawn up for the two past official years, 1851-52 and 1852-53, and furnishes the information required by Lieutenant Chapman in the 2nd clause of the 3rd paragraph of his communication to your address.

2. The average of the amount of freight from stations of export and import has been given, in consequence of the practice existing of merchants freighting boats by the trip, and not by the mile: the rate of the freight varies according to the rise and fall of trade, and the fair and wet seasons of the year tend to make a great difference in this respect.

I have, &c.
(Signed) M. M. D'ABREO,
Clerk in Charge.

Khettie Custom House, 3rd June 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

APPENDIX D.

Statement showing the Return of the Number of Passengers and Tonnage of Goods conveyed by the Steamers of the Indus Flotilla, up and down River, from 1st May 1851 to 30th April 1853.

From what to what Station.	Tonnage of Goods by Weight, per Maund of 80 lbs.	Tonnage of Goods by Measurement of Cubic Feet.	Number of Private Passengers.						Carriages, &c.			Specie or Bullion.	Goats.	Dogs.
			1st Class.	2nd Class.	3rd Class.	4th Class.	Children in Cabin.	Children on Deck.	Carriages.	Buggies.	Palkees.			
												Rs.		
From Kurrachee to Mooltan, from 1st May 1851 to 30th April 1852..	2,271 68	1,409 11	4	7	4	27	..	..	..	..	..	....	..	..
Ditto ditto ditto, from 1st May 1852 to 30th April 1853	4,855 25	2,438 0	8	4	20	40	..	2	..	..	..	....	..	..
From Mooltan to Kurrachee, from 1st May 1851 to 30th April 1852..	673 7	812 3	7	9	3	13	6	..	..	..	..	....	..	1
Ditto ditto ditto, from 1st May 1852 to 30th April 1853..	2,096 57	26 2	29	20	19	33	14	1	..	..	..	...	..	3
From Kurrachee to Sukkur, from 1st May 1851 to 30th April 1852..	3,013 70	300 1	..	3	1	3	..	1	..	..	1	....	..	..
Ditto ditto ditto, from 1st May 1852 to 30th April 1853..	2,725 37	707 2	5	4	7	23	4	..	1	1	1	....	..	1
From Sukkur to Kurrachee, from 1st May 1851 to 30th April 1852..	2,425 7	587 4	3	..	1	6	..	..	..	..	..	....	..	1
Ditto ditto ditto, from 1st May 1852 to 30th April 1853..	4,018 40	.....	6	5	12	33	2	1	..	..	1	....	..	1
From Kurrachee to Kotree, from 1st May 1851 to 30th April 1852..	763 28	696 8	1	..	..	6	..	1	..	..	..	....	..	..
Ditto ditto ditto, from 1st May 1852 to 30th April 1853..	584 22	547 2	10	4	20	31	2	5	..	1	3	....	..	..
From Kotree to Kurrachee, from 1st May 1851 to 30th April 1852..	122 45	180 2	6	16	2	53	3	2	..	..	..	2,250	..	1
Ditto ditto ditto, from 1st May 1852 to 30th April 1853..	72 6	886 0	11	15	24	88	5	13	..	..	..	3,880	1	4
Total..	23,622 12		90	87	113	356	36	26	1	2	6	6,130	1	12

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

(Signed) R. ETHERSEY, Captain, I. N.,
Commanding Indus Flotilla.

APPENDIX E.

Statement showing the Number of Government Troops, Stores, and Passengers, conveyed by the different Steamers and Flats of the Indus Flotilla, between Kurrachee and Mooltan, and vice versâ, *between the 1st February* 1848 *and 30th April* 1853.

No. of Troops.	Government Stores: Quantity or No. of Packages.	Government Stores: Tonnage.				No. of Government Passengers.	Remarks.
		Tons.	cwt.	qrs.	lbs.		
28,022	133,319	10,935	13	3	21¾	20,831	The Stores comprise Military, Ordnance, Commissariat, and Flotilla Stores, which are usually numerous and bulky; grain for the Commissariat Departments in the province; boxes of treasure; iron stores for the Punjaub, which have been excessively heavy, and will in all probability increase yearly; Regimental kit and baggage of Troops; and ale and porter for the Punjaub, which will also increase in quantity.

Kotree, 23rd June 1853.

(True copy)

W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

(Signed) R. ETHERSEY, Captain I. N.,
Commanding Indus Flotilla.

APPENDIX F.

Abstract of the Police Returns, showing the Total of the different Stations on the High Road between Kurrachee and Kotree.

Police Stations.	Carts.	Camels.	Horses.	Donkeys and Mules.	Horned Cattle.	Sheep and Goats.	Porters with Loads.	European Foot Passengers.	Native Foot Passengers.	Palkees and Litters.	European Carriages.
Jemedar-ke-Landi	201	7,697	7,162	6,940	7,416	1,684	7,287	392	46,958	93	56
Gharra..	146	....	....	....	....	....	....	....	....	....	....
Tatta	132	....	....	....	....	....	....	....	....	....	....
Jerruck	66	4,391	2,339	3,843	4,460	5,561	718	81	21,094	7	13
Mean of Jemedar-ke-Landi and Jerruck..	133	6,044	4,750	5,391	5,938	3,622	4,002	236	34,026	50	34
Deduct one-third	44	2,014	1,583	1,797	....	....	....	Passengers.	⅓ above for Passengers.	....	....
	89	4,030	3,167	3,594	....	....	4,002	236	11,342	....	....

ABSTRACT.

89 carts, at 12 maunds each	.. 1,068	maunds	} or 1,571 tons.
4,030 camels, at 7 „ „	.. 28,210	„	
3,167 horses, at 2 „ „	.. 6,334	„	
3,594 donkeys, at 1½ „ „	.. 5,391	„	
4,002 porters, with loads, at ¾ maund each	.. 3,001	„	
	44,004	maunds	

(True abstract)

W. CHAPMAN, Lieutenant,
Engineers.

Return of the Traffic at the undermentioned Places, from June 1852 to May 1853, inclusive, compiled from the Monthly Returns furnished by the Police Authorities.

	Jemedar-ke-Landi.											Gharra.										
	Carts.	Camels.	Horses.	Donkeys and Mules.	Horned Cattle.	Sheep and Goats.	Porters with Loads.	Foot Passengers, European.	Foot Passengers, Native.	Palkies or Litters.	European Carriages.	Carts.	Camels.	Horses.	Donkeys and Mules.	Horned Cattle.	Sheep and Goats.	Porters with Loads.	Foot Passengers, European.	Foot Passengers, Native.	European Carriages.	Palkies or Litters.
1852.																						
June	19	722	316	463	406	58	641	5	1,307	2	2	..	1,696	962	1,421	910	2,409	243	16	3,624	1	..
July	12	950	398	395	344	42	1,421	6	1,329	..	..	..	848	691	1,240	1,920	1,640	1,779	11	2,753	..	..
August	..	500	339	430	263	63	853	5	1,343	1	..	..	389	561	978	2,774	2,468	1,513	..	2,462	1	..
September	1	682	559	639	614	143	413	10	1,339	3	..	..	236	511	934	1,091	1,834	1,370	1	2,282	..	..
October	..	812	685	595	720	112	315	29	2,722	5	2	..	1,709	1,470	3,172	622	5,197	3,220	12	3,219	3	1
November	13	792	882	478	812	80	682	28	6,985	6	..	3	1,192	666	1,793	240	3,093	1,718	3	2,996	1	..
December	12	1,235	927	635	879	75	598	33	7,879	18	15	7	1,892	821	1,081	1,777	62	2,182	25	3,760	10	6
1853.																						
January	20	458	1,112	847	927	109	735	75	7,975	25	7	9	2,648	1,178	1,821	3,140	2,078	3,101	38	4,196	16	2
February	42	119	1,019	994	1,124	48	712	38	2,562	4	10	42	1,531	775	1,434	1,350	12	1,094	19	3,648	..	5
March	25	457	389	512	585	112	372	87	4,912	15	12	13	3,715	2,666	2,337	3,019	790	2,061	32	4,714	4	5
April	27	430	157	540	415	625	289	49	5,678	12	5	39	3,593	3,039	2,618	4,547	1,300	2,689	39	4,970	3	1
May	30	540	379	412	327	217	256	27	2,927	2	3	33	4,349	3,047	3,114	5,121	303	3,712	14	5,493	..	1
Total	201	7,697	7,162	6,940	7,416	1,684	7,287	392	46,958	93	56	146	23,798	16,387	21,943	26,511	21,186	24,682	210	44,117	39	21
Gharra	146	23,798	16,387	21,943	26,511	21,186	24,682	210	44,117	39	21											
Tatta	132	13,438	6,850	6,052	9,041	4,138	5,142	218	34,475	34	15											
Jerruck	66	4,391	2,339	3,843	4,460	5,561	718	81	21,094	7	13											
Total	344	41,627	25,576	31,838	40,012	30,885	30,542	509	99,686	80	49											
Grand Total	545	65,425	32,738	38,778	47,528	32,569	37,829	901	146,644	173	103											
Mean of the above four places	136	16,356	8,184	9,694	11,882	8,142	9,457	225	36,661	43	25											

	Tatta.										Jerruck.									
	Carts.	Camels.	Horses.	Donkeys and Mules.	Horned Cattle.	Sheep and Goats.	Porters with Loads.	Foot Passengers, European.	Foot Passengers, Native.	Palkies or Litters.	European Carriages.	Carts.	Camels.	Horses.	Donkeys or Mules.	Horned Cattle.	Sheep and Goats.	Porters with Loads.	Foot Passengers, European.	Foot Passengers, Native.	Palkies or Litters.	European Carriages.
1852.																						
June	4	1,028	503	391	465	316	62	22	2,842	2	..	2	473	191	187	255	210	52	6	1,708	1	..
July	..	1,534	863	583	744	632	3	9	3,133	..	..	..	316	137	214	179	952	45	4	1,273	..	..
August	..	511	615	449	721	273	12	..	2,216	1	..	..	191	123	262	959	690	51	4	1,824	1	..
September..	..	419	388	215	328	568	24	..	2,558	1	..	..	..	166	174	578	1,037	24	3	1,562	1	..
October	..	15	489	256	1,063	1,206	65	24	2,516	4	1	..	345	174	236	717	758	43	4	1,629	..	..
November..	2	1,058	667	404	873	130	56	14	2,579	2	..	1	504	163	192	173	720	68	2	140	..	..
December..	12	2,120	617	476	901	71	158	20	3,626	12	..	7	649	167	484	278	26	116	21	1,844	1	1
1853.																						
January	10	1,594	561	374	1,005	140	18	19	3,201	7	4	7	140	359	319	183	566	32	7	2,438	2	..
February	46	1,401	553	565	718	319	4	29	3,642	..	6	33	412	218	521	280	38	74	7	1,860	..	5
March	15	1,340	591	817	984	80	1,647	36	3,451	3	3	3	431	180	582	281	205	47	13	2,182	..	7
April	18	1,296	608	781	660	253	1,780	33	2,984	2	..	3	475	246	476	263	59	101	6	2,586	1	..
May	25	1,122	394	741	579	150	1,312	12	1,727	..	1	10	455	215	196	314	300	65	4	2,048	..	..
Total	132	13,438	6,850	6,052	9,041	4,138	5,142	218	34,475	34	15	66	4,391	2,339	3,843	4,460	5,561	718	81	21,094	7	13
Jemedar-ke-Landi Return..												201	7,697	7,162	6,940	7,416	1,684	7,287	392	46,958	93	56
2)												267	12,088	9,501	10,783	11,876	7,245	8,005	473	68,052	100	69
Mean of Jemedar-ke-Landi and Jerruck..												133	6,044	4,750	5,391	5,938	3,622	4,002	236	34,026	50	34

(True Abstract of Monthly Returns in the Commissioner's Office)

W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, September 1853.

APPENDIX G.

Abstract of Statement given by Camp Merchants in writing of the Overland Trade of their respective Firms.

Names of Camp Merchants.	Camels.	Carts.	Coolies.	Load, Camel.	Load, Cart.	Load, Coolie.	Total.	Remarks.
				lbs.	lbs.	lbs.	lbs.	
Treacher and Co..	141	....	....	300	....	....	42,300	
Cursetjee Cowasjee	53	....	....	....	....	....	50,880	
Jehangeer Nasserwanjee	None.	....	....	....	....	....	....	
Ruttonjee Framjee	107	....	....	261	....	....	27,927	Several other Merchants and Bhoras were applied to for similar information, but no replies were received.
Jhanjeer Bhomajee	None.	....	....	....	....	....	....	
Merwanjee and Co.	75	....	....	150	....	....	11,250	
Pestonjee Rajkota	30	25	4	320	960	40	33,760	
						Total..	166,117	Or 74.2 tons.

(Signed) W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, October 1853.

Abstract of Roll of Merchandize forwarded by the different Overland Routes by the Merchants, Residents, and Agents, in the Town of Kurrachee.

	Number reported.		Proportion to be taken as going through.		Camel Load 600 lbs.	Tattoo Load 240 lbs.	Total Tons.	Remarks.
	Camels.	Tattoos.	Camels.	Tattoos.				
Kurrachee Merchants	7,406	25	7,406	25	At 600 lbs. each, 13,698 × 600 lbs. = 8,218,800 lbs.	At 240 lbs. each, 455 × 240 = 109,200 lbs.	Camels 3,669 tons. Tattoos 48.7 tons.	
Shikarpore ditto	1,696	....	1,696	....				Sett Narian Doss and others taking two-thirds over the whole distance.
Ditto ditto	596	....	596	....				
Tatta ditto	1,600	430	1,067	430				
Kojahs, Rs. 50,000, at Rs. 125 per camel ..	400	....	400	....				Take half most probably, for short distances.
Miscellaneous, Rs. 1,00,000	800	....	400	....				
Imports by Land, estimated at Rs. 4,00,000, at Rs. 125 per camel	3,200	....	2,133	....				Suppose two-thirds to pass over the whole distance.
Total .. .. .. Tons			13,698	455			3,717.7	

	Tons.
Camp Merchants as above	74.2
Town Merchants	3,717.7
Total	3,792.0

W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

Kurrachee, November 1853.

Roll of the Merchants residing in Kurrachee, showing the Amount of Merchandize transported by them during the Year 1852 *from Kurrachee up Country, Weight and Approximate Value of each Load, and the Number of Camels and Tattoos used for the carriage thereof.*

No.	Names of Merchants.			Camels.			Tattoos.			Total Value of Loads.			Remarks.
	Name of Owner.	Resident of	Name of Agent or Carrier.	No.	Value of Load.		No.	Value of Load.					
	Merchants of Kurrachee.				Rs.	A. P.		Rs.	A. P.	Rs.	A. P.		
1	Sett Khemchund	Kurrachee	.....	100	12,500	0 0	25	5,000	0 0	17,500	0 0		
2	Sett Ayudass	Majundeh	Khanchund	350	23,750	0 0	..	.....		23,750	0 0		
3	Numga Bhattia	Gumbat	Kawul wullud Hassah	400	50,000	0 0	..	.....		50,000	0 0		
4	Sawutt wullud Golla	Ditto	Mungut wullud Oomema	380	47,500	0 0	..	.....		47,500	0 0		
5	Gool Patolee	Allyar-ke-Tanda	Godoo Bhattia	160	19,000	0 0	..	.....		19,000	0 0		
6	Seekeeamull	Gumbat	Gooloomull wullud Butchamull	625	78,125	0 0	..	.....		78,125	0 0		
7	Gungoomull wullud Hoonda	Gorrabarry	Ramjeemull	128	16,100	0 0	..	.....		16,100	0 0		
8	Muggunmull wullud Chutta	Ditto	Achoomull wullud Amund	571	91,375	0 0	..	.....		91,375	0 0		
9	Nuwoomull	Kurrachee	Mahboob wullud Khemchund	80	10,000	0 0	..	.....		10,000	0 0		
10	Anoomull wullud Endass	Majundeh	.....	141	16,625	0 0	..	.....		16,625	0 0		
11	Narroomull wullud Butcha	Barry	Gungoomull	272	34,000	0 0	..	.....		34,000	0 0		
12	Tarramull wullud Tawoomull	Sehwan	.....	208	26,000	0 0	..	.....		26,000	0 0		
13	Oomurnamull wullud Assanund	Allyar-ke-Tanda	.....	64	8,000	0 0	..	.....		8,000	0 0		
14	Ayudass	Majundeh	Dinomull wullud Tillokchund	225	28,125	0 0	..	.....		28,125	0 0		
15	Husraz wullud Gain	Ragoo Ghotna	.....	64	8,000	0 0	..	.....		8,000	0 0		
16	Bhooromull wullud Daivun	Sehwan	.....	245	30,625	0 0	..	.....		30,625	0 0		
17	Kawulmull wullud Rajoonund	Allyar-ke-Tanda	Hurput wullud Allumchund	60	7,500	0 0	..	.....		7,500	0 0		
18	Sungut Wurrie	Ditto	Sukoomull wullud Lallchund	128	16,100	0 0	..	.....		16,100	0 0		
19	Tellchund wullud Chundun	Gumbat	.....	160	19,000	0 0	..	.....		19,000	0 0		
20	Suntoo wullud Chellah	Ditto	.....	322	40,250	0 0	..	.....		40,250	0 0		
21	Gungoo wullud Toolsia	Allyar-ke-Tanda	Duryanah wullud Sookhoo	172	21,500	0 0	..	.....		21,500	0 0		
22	Vapareemull	Hyderabad	Bhumba wullud Tacoordass	601	75,125	0 0	..	.....		75,125	0 0		
23	Alla Bux	Tatta	Bheewa wullud Suchanund	625	78,125	0 0	..	.....		78,125	0 0		
24	Tarachund Mookhie	Hyderabad	Amvut wullud Suchanund	400	50,000	0 0	..	.....		50,000	0 0		
25	Dhoola wullud Gunoo	Ditto	.....	250	31,250	0 0	..	.....		31,250	0 0		
26	Wunundmull	Ditto	Bhomull wullud Susanah	200	25,000	0 0	..	.....		25,000	0 0		
27	Halfiz Wurrianee	Tatta	Roshun wullud Niboodha	250	31,250	0 0	..	.....		31,250	0 0		
28	Goolam wullud Kadindinah	Ditto	.....	225	28,125	0 0	..	.....		28,125	0 0		
					9,22,950	0 0		5,000	0 0	9,27,950	0 0		Total camels 7,406; tattoos 25.

No.	Names of Merchants.			Camels.			Tattoos.			Total Value of Loads.			Remarks.
	Name of Owner.	Resident of	Name of Agent or Carrier.	No.	Value of Load.		No.	Value of Load.					
	Merchants of Shikarpore.				Rs. A. P			Rs. A. P.		Rs. A. P.			
1	Mungoomull	Shikarpore	Rungoomull wullud Khooshial.	150	45,000 0 0		..	.....		45,000 0 0			
2	Lallchund wullud Boollamull ..	Ditto	.....	150	45,000 0 0		..	.....		45,000 0 0			
3	Madowdass	Ditto	Purushram wullud Chumondass	100	30,000 0 0		..	.....		30,000 0 0			
4	Choowur wullud Nanoo	Ditto	.....	150	45,000 0 0		..	.....		45,000 0 0			
5	Ramdass	Ditto	Beerban	150	45,000 0 0		..	.....		45,000 0 0			
6	Heeranund wullud Meghraz	Ditto	.....	250	75,000 0 0		..	.....		75,000 0 0			
7	Boollamull wullud Mohunmull ..	Ditto	.....	150	45,000 0 0		..	.....		45,000 0 0			
8	Narraindass wullud Goollamull..	Ditto	Jumnadass	325	97,500 0 0		..	.....		97,500 0 0			
9	Rahakisson wullud Nundram ..	Ditto	Meghraz wullud Suchanund ..	271	81,300 0 0		..	.....		81,300 0 0			
					5,08,800 0 0			.....		5,08,800 0 0			Total camels 1,696.
	Merchants of Tatta.												
1	Assoomull	Tatta	Takoordass wullud Runchore..	25	3,125 0 0		25	5,000 0 0		8,125 0 0			
2	Assoomull Ghunsawun	Ditto	Loodhunmull Bhattia	25	3,125 0 0		25	5,000 0 0		8,125 0 0			
3	Alla Bux Sakranee	Ditto	Gungoomull wullud Mungoo-mull	100	12,500 0 0		25	5,000 0 0		17,500 0 0			
4	Damoother	Ditto	Gowmull wullud Samee	100	12,500 0 0		25	5,000 0 0		17,500 0 0			
5	Assumull wullud Kissamul	Ditto	.....	250	31,250 0 0		50	10,000 0 0		41,250 0 0			
6	Wussund wullud Karra	Ditto	.....	250	31,250 0 0		50	10,000 0 0		41,250 0 0			
7	Edun wullud Kissamull	Ditto	.....	250	31,250 0 0		50	10,000 0 0		41,250 0 0			
8	Ruttonmull wullud Kissamull ..	Ditto	.....	250	31,250 0 0		50	10,000 0 0		41,250 0 0			
9	Jettamull wullud Heina	Ditto	.....	150	18,750 0 0		40	8,000 0 0		26,750 0 0			
10	Gundoo wullud Lukku	Ditto	.....	100	12,500 0 0		25	5,000 0 0		17,500 0 0			
11	Hafiz Wumanee	Ditto	Roshun wullud Nibooda	100	12,500 0 0		40	8,000 0 0		20,500 0 0			
					2,00,000 0 0			81,000 0 0		2,81,000 0 0			Total camels 1,600; tattoos 430.
			Grand Total..	....	16,31,750 0 0			86,000 0 0		17,17,750 0 0			

(True copy)
W. CHAPMAN, Lieutenant,
Engineers.

List showing the names of the Jhutts employed by the Merchants for the conveyance of their Merchandize.

No.	Names.	Caste.	Residence.
1	Ghoolam Hoosain	Lusharie	Sehwan.
2	Chutton		
3	Joomah..		
4	Goolam Allie		
5	Mohobut		
6	Peeranah	Bubur	
7	Kandeyra		
8	Loung	Behranee	
9	Mahomed	Bullad	
10	Hazie	Gudda	
11	Moobaruck	Lusharie	
12	Meer Khan	Kosha	Hyderabad.
13	Ranah	Behranee	Hillayah.
14	Sunzur..		
15	Khubud..		
16	Bhuria..	Gudda	Kotree.
17	Adil	.....	Allyar-ke-Tanda.
18	Dittah	Bubur	Sehwan.
19	Mewah Jhutt	.....	Majundeh.
20	Mahomed Alley Jhutt..	.....	Sehwan.
21	Rohill Chandia..	Chandia	
22	Puklua Meer Jhutt	.....	
23	Bungul Meer Jhutt	.....	
24	Dosee	Sohah	

(True copy)

W. CHAPMAN, Lieutenant,
Engineers.

Estimate of the Average Load carried by Camels and Tattoos, and Approximate Value of each Load.

A camel load varies from 7 to 8 maunds; the merchants pay for 8 maunds. It is optional with the Jhutts to use one or more animals for this load.

The value of a camel load of goods belonging to a Kurrachee merchant is averaged as low as Rs. 125, which is attributable to many of the loads consisting of grocery, cocoanuts, and dates, the maximum value of the loads being Rs. 130, minimum Rs. 12: the most valuable loads consist of sugar-candy.

The Shikarpore merchants' loads are much more valuable, consisting chiefly of silks and fine cloth, the maximum value of such being Rs. 800, minimum Rs. 500, average value Rs. 300.

The load of a tattoo is three maunds, valued at Rs. 200 per load, and is thus highly priced, as it consists of valuable silks and fine cloth.

From information obtained from various individuals, it is calculated that last year the Kurrachee merchants forwarded Rs. 9,27,950 worth of merchandize.

The Shikarpore merchants, or their Agents residing in Kurrachee, Rs. 3,30,000 worth, the Tatta merchants Rs. 2,86,000.

The amount of the Kojahs' has not been ascertained, as also of one of Shikarpore, Sett Narraindoss, but the amount of merchandize transported up country by these parties is supposed to be about one lakh.

It is estimated that one lakh of goods is transported away by various people who do not reside permanently in Kurrachee, but come in to hire out their camels at the opening of the season. The above account gives a total of Rs. 17,43,950 worth of goods transported from Kurrachee bunder. I feel pretty sure that this falls far short of the actual amount that was transported; but from a great dislike on the part of the merchants to disclose the amount of their business, from a foolish dread that the inquiry is only a forerunner of some kind of limitation, it was impossible to gain very accurate information on this subject.

I have adopted measures for procuring a correct account of goods transported up country during the present year.

The names of the camel-men who actually took away each load could not be ascertained, but a list is furnished of the men who are usually employed as Jhutts by these merchants.

Since writing the above, I have obtained the account of the Shikarpore Sett Narraindoss, which amounts to Rs. 97,500, and that of another Shikarpore merchant, named Radda Kishun, amounting to Rs. 81,300, and estimating the amount of the Kojahs at half a lakh, we have a grand total of eighteen lakhs, ninety-two thousand, seven hundred and fifty (18,92,750). Imports by land are estimated at four lakhs, and consist chiefly of oil seeds, mustard seed, wheat, bajeree, and coloured cloth from Upper Scinde.

(Signed) E. P. ARTHUR,
Officiating Captain of Police.

Kurrachee, 10*th October* 1853.

(True copies)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

APPENDIX H.

No. 406 OF 1853.

To LIEUTENANT CHAPMAN, Engineers,

On Special Duty, Scinde,

Kurrachee.

SIR,

In acknowledging the receipt of your letter of the 12th May last, I would beg leave to submit to you, that my knowledge of the country between Kurrachee and the line of the Indus is very limited. I would mention, however, casually, for your consideration, that Jerruck is a fixed position, which is not the case with Kotree, and that the former on that account would appear to be better adapted as a terminus to a railway. In addition to the above, I might mention that in the direct line to Kotree is the Bharun river, at times a wide, rapid, and dangerous stream, which might materially interfere with, as well as add to, the expense of the projected work.

2. There can be no doubt as to the benefits which must accrue to the province should a line of railway be carried out between Kurrachee and any point on the river. At present the traffic is conducted partly by camels between Sehwan, Kotree, and Kurrachee, and in part by the river doondas, which navigate the tidal channels at all seasons of the year: both are most tedious, and far from inexpensive, owing to the waste of time, more especially in the case of doondas, as also to the serious losses which occasionally occur, owing to the foundering of these unwieldy craft. In rainy weather, laden camels are unable to travel, so that the road line may be considered closed should a wet season occur.

3. As my duty extends to the registry of the external trade only, I am able to say nothing positive with regard to the internal traffic by land. One point, however, I am satisfied of—that is, that the whole of the trade which now finds its way by the direct line to Sehwan, to Kotree, and to Tatta, and by doondas and other cargo boats by the tidal channels, will all enter the railroad.

4. The external trade of Scinde has steadily increased at the rate of 20 per cent. per annum for several years past: this may form an index, though but a faint one, to the future progress of the province. We have already commenced a direct traffic with England, and once we are able to export produce to the mother country, Kurrachee will command the trade of Mekran, of Eastern Arabia, and of the Persian Gulf.

5. I may also add that the Indus, though nominally open to commerce since Lord Ellenborough's proclamation after the conquest of the country in 1843, yet was virtually sealed up to the beginning of last year, when river dues were finally abolished: we may therefore expect that the raw produce of the Punjaub and the North-West Provinces will now find its way continuously and uninterruptedly by the line of the Indus, in exchange for the manufactures of Europe—a trade which has already received considerable impetus from the establishment of the regular monthly steamer between Mooltan and Kurrachee. And here I must not forget to mention the important fact that the Indus is now the highway for Troops and Military stores to the Punjaub and Upper India. During the present year 5,000 casks of ale and porter alone passed through Kurrachee, and as much more is

hourly expected. All this is conveyed in carts from Kemaree to Ghizree, a distance of 6 miles, where it is shipped in country boats, many of which will spend the greater part of a month in the salt-water creeks before they get to the Indus. The cost of all these operations has yet to be ascertained, but were the projected railway in existence, there cannot remain a doubt, that not only a considerable saving would be made in carriage, but that the article itself would have every chance of reaching the Indus in good order and condition,—a point which, under present arrangements, must be considered doubtful.

6. I have, in conclusion, to regret that I am unable to furnish you with more precise information on the various subjects touched on by you. The tables which accompany this are—

1*st*,—The last Trade Report of External Commerce.

2*nd*,—An Abstract of Shipping for 1852-53, with remarks thereon.

3*rd*,—Statement of the River Traffic for 1851-52 and 1852-53, as registered at Khettie.

I have the honour to be, Sir,
Your most obedient Servant,
(Signed) J. MACLEOD,
Deputy Collector of Customs.

Kurrachee Custom House, 19*th October* 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

Shipping Arrivals, 1852-53.

At Kurrachee.	Bombay.						Concan.						Cutch.						Goa and Demaun.	
	Merchandize.		Government Stores and Troops.		Empty.		Merchandize.		Government Stores and Troops.		Empty.		Merchandize.		Government Stores and Troops.		Empty.		Merchandize.	
	Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
August 1852	2	425	..	..	..	..	..	..	..	..	..	..	2	80	..	..	..	..	..	..
September..	13	1,228	2	83	..	..	..	..	3	130	..	..	12	475	5	117	5	138	..	..
October	36	2,316	3	171	..	..	..	..	1	27	..	..	16	519	..	..	1	12	..	..
November..	39	2,505	4	187	..	..	2	68	..	..	..	..	22	661	9	413	..	..	5	195
December	39	2,232	22	1,012	..	..	2	76	..	..	..	..	16	456	3	114	4	92	3	107
January 1853	39	2,892	4	320	1	1,354	..	..	..	..	..	..	23	692	13	597	2	77	..	..
February..	38	2,463	3	229	1	33	4	115	..	..	..	..	25	731	..	..	1	17	2	39
March	51	3,138	..	..	..	..	8	289	..	..	1	33	28	844	..	..	2	179	..	..
April	35	2,150	..	..	..	..	2	74	..	..	..	..	21	696	..	..	3	90	..	..
May	44	2,170	..	..	..	..	3	85	..	..	..	..	7	335	..	..	1	50	..	..
June	4	174	..	..	..	..	1	30	..	..	..	..	..	..	..	..	..	..	..	..
July	..	....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	340	21,693	38	2,002	2	1,387	22	737	4	157	1	33	172	5,489	30	1,283	19	655	10	341
Khettie.	120	4,242	..	..	..	..	28	1,038	..	..	..	..	217	5,040	..	..	..	..	2	70
	460	25,935	38	2,002	2	1,387	50	1,775	4	157	1	33	389	10,529	30	1,283	19	655	12	411

Shipping Arrivals, 1852-53 (continued).

At Kurrachee.	Guzerat.				Malabar.		Arabian and Persian Gulfs.				Mekran.				Scinde.					
	Merchandize.		Government Stores and Troops.		Merchandize.		Merchandize.		Empty.		Merchandize.		Empty.		Merchandize.		Government Stores and Troops.		Empty.	
	Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
August 1852	..	..	..	..	..	..	3	58	..	..	..	..	..	..	33	363	..	..	..	..
September	..	..	..	..	..	..	15	556	..	..	3	55	1	15	128	1,574	..	..	..	..
October	2	88	..	..	..	..	13	585	..	..	2	32	1	15	143	1,788	..	..	..	..
November	11	433	..	..	4	163	13	460	..	..	4	107	..	..	111	1,403	..	..	1	10
December	7	233	..	..	3	144	9	378	..	..	3	47	1	62	121	1,383	2	19	3	82
January 1853	3	119	2	224	7	496	5	219	1	38	7	172	..	..	111	1,283	..	..	..	..
February	8	447	..	..	15	785	4	242	..	..	10	220	..	..	127	1,474	..	..	..	..
March	6	237	1	62	12	717	5	197	..	..	9	133	4	98	165	2,042	..	..	..	..
April	5	198	..	..	1	54	..	..	..	..	3	66	..	..	125	1,615	..	..	2	19
May	10	510	..	..	6	347	1	56	..	..	..	..	..	..	132	1,587	..	..	1	10
June	..	..	..	..	..	..	2	82	..	..	..	..	..	..	56	518	..	..	..	..
July	..	..	..	..	..	..	..	..	..	..	..	..	..	..	27	258	..	..	..	..
	52	2,265	3	286	48	2,706	70	2,833	1	38	41	832	7	190	1,279	15,288	2	19	7	121
Khettie	4	112	..	..	5	218	22	333	..	..	..	..	..	..	..	..	..	..	..	..
	56	2,377	?	286	53	2,924	92	3,166	1	38	41	832	7	190	1,279	15288	2	19	7	121

Shipping Departures, 1852-53.

From Kurrachee.	Bombay.						Concan.				Cutch.						Goa and Demaun.			
	Merchandize.		Government Stores and Troops.		Empty.		Merchandize.		Empty.		Merchandize.		Government Stores and Troops.		Empty.		Merchandize.		Empty.	
	Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
August 1852	2	450	..	..	..	..	..	..	..	..	1	12	..	..	..	..	..	..	..	..
September	29	2,010	..	..	1	70	..	..	..	..	6	176	..	..	1	19	..	..	..	..
October	36	2,513	..	..	1	54	..	..	..	..	1	34	..	..	5	170	..	..	2	56
November	40	3,105	9	482	1	115	..	..	..	..	5	118	..	..	9	242	2	37	2	62
December	47	2,631	..	..	2	139	..	..	1	42	13	332	10	415	4	116	1	30	2	94
January 1853	40	2,377	..	..	..	..	..	..	..	..	16	516	24	1,128	5	116	..	..	..	..
February	33	2,262	..	..	..	..	..	..	..	..	8	163	8	494	7	248	..	..	..	..
March	38	2,678	..	..	2	73	..	..	2	58	13	416	1	52	10	315	..	..	2	85
April	34	2,627	..	..	2	99	..	..	..	..	10	299	..	..	6	369	..	..	3	91
May	33	2,084	..	..	..	..	..	..	..	..	10	480	..	..	9	466	..	..	6	225
June	..	..	..	..	1	289	..	..	..	..	4	279	..	..	3	203	..	..	..	..
July	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	332	22,737	9	482	10	839	..	..	3	100	87	2,825	43	2,089	59	2,264	3	67	17	613
Khettie	299	10,709	..	..	..	..	..	..	..	..	186	3,905	..	..	..	..	8	266	..	..
	631	33,446	9	482	10	839	..	..	3	100	273	6,730	43	2,089	59	2,264	11	333	17	613

Shipping Departures, 1852-53 (continued).

From Kurrachee.	Guzerat.				Malabar.				Arabian and Persian Gulfs.				Mekran.				Scinde.					
	Merchandize.		Empty.		Merchandize.		Empty.		Merchandize.		Empty.		Merchandize.		Empty.		Merchandize.		Government Stores and Troops.		Empty.	
	Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
August 1852	..	..	..	..	..	..	..	..	..	..	..	..	1	17	..	..	29	446	..	..	36	443
September	1	23	..	..	..	..	..	..	4	172	..	..	3	53	6	218	38	458	..	..	97	1,241
October	2	26	..	..	..	..	1	84	6	311	1	30	6	207	3	85	70	862	..	..	99	1,750
November	2	65	1	27	1	41	..	..	6	222	2	89	6	123	4	119	60	778	..	..	49	780
December	2	73	..	..	19	866	2	91	3	107	..	..	4	82	5	115	64	807	10	147	71	989
January 1853	4	135	3	124	..	..	..	..	4	189	..	..	6	174	2	26	30	396	1	45	108	1,632
February	1	39	..	..	..	..	..	..	2	75	1	39	13	332	4	47	27	423	..	..	102	1,526
March	6	233	6	306	..	..	..	..	4	145	..	..	4	151	1	15	55	873	..	..	174	3,070
April	1	30	4	199	..	..	..	..	5	145	..	..	4	157	2	42	52	766	..	..	99	1,870
May	2	65	..	..	..	..	..	..	2	75	..	..	4	122	1	37	39	462	..	..	88	1,086
June	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28	645	..	..	44	423
July	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21	300	..	..	18	165
	21	689	14	656	20	907	3	175	36	1,441	4	158	51	1,421	28	704	513	7,236	11	192	985	14,975
Khettie	7	293	..	..	..	..	..	..	9	170	..	..	..	..	..	..	..	..	..	..	..	..
	28	982	14	656	20	907	3	175	45	1,611	4	158	51	1,421	28	704	513	7,236	11	192	985	14,975

Abstract of Shipping for 1852-53.

Ports.	Arrivals.								Departures.							
	Merchandize.		Government Stores and Troops.		Empty.		Total.		Merchandize.		Government Stores and Troops.		Empty.		Total.	
	Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.		Vessels.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Bombay	460	25,935	38	2,002	2	1,387	500	29,324	631	33,446	9	482	10	839	650	34,767
Concan	50	1,775	4	157	1	33	55	1,965	..	..	..	..	3	100	3	100
Cutch	389	10,529	30	1,283	19	655	438	12,467	273	6,730	43	2,089	59	2,264	375	11,083
Goa and Demaun	12	411	..	..	..	..	12	411	11	333	..	..	17	613	28	946
Guzerat..	56	2,377	3	286	..	..	59	2,663	28	982	..	..	14	656	42	1,638
Malabar	53	2,924	..	..	..	..	53	2,924	20	907	..	..	3	175	23	1,082
Arabian and Persian Gulfs..	92	3,166	..	..	1	38	93	3,204	45	1,611	..	..	4	158	49	1,769
Mekran	41	832	..	..	7	190	48	1,022	51	1,421	..	..	28	704	79	2,125
Total	1,153	47,949	75	3,728	30	2,303	1,258	53,980	1,059	45,430	52	2,571	138	5509	1,249	53,510
Scinde	1,279	15,288	2	19	7	121	1,288	15,428	513	7,236	11	192	985	14,975	1,509	22,403
Grand Total	2,432	63,237	77	3,747	37	2,424	2,546	69,408	1,572	52,666	63	2,763	1,123	20,484	2,758	75,913

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

(Signed) J. MACLEOD,
Deputy Collector of Customs.

From these statements it will be observed, that the amount of tonnage entered inwards in 1852–53 amounted to say 48,000 tons, exclusive of the provincial coasting trade; and that the outgoing tonnage was 45,000 tons.

It would not, however, be correct to assume these figures as the amount or weight of our internal traffic, or rather as the weight of the traffic passing between Kurrachee and the upper country by the line of the proposed railway. To estimate this traffic, we must exclude from the above figures, 1*st*, the consumption at Kurrachee, Khettie, and the neighbouring places; 2*nd*, the imports and exports across our western frontier; and 3*rd*, an allowance should be made for the partial lading of vessels. The balance may then be taken as the probable amount of traffic which passed upwards and downwards.

Ports.	Arrivals.			Departures.		
	Tonnage of Merchandize as registered.	Deduct Allowance as above.	Probable Amount passed upwards by Land & River.	Tonnage of Merchandize as registered.	Deduct Allowance as above, Re-exports.	Probable Amount brought down by Land and River.
Bombay	25,935	6,935	19,000	33,446	8,446	25,000
Concan	1,775	1,775	....	....	....	....
Cutch	10,529	7,529	3,000	6,730	2,730	4,000
Goa and Demaun	411	411	....	333	183	150
Guzerat	2,377	2,177	200	982	682	300
Malabar	2,024	1,424	1,500	907	907	....
Arabian and Persian Gulfs....	3,166	1,166	2,000	1,611	811	800
Mekran	832	432	400	1,421	721	700
Tons.....	47,049	21,849	26,100	45,430	14,480	30,950

As the internal traffic of the province has not been registered, the above is the only data that can be offered for a railway statistic. This department has not the means of estimating the village to village traffic, nor the number of passengers passing upwards and downwards, both of which form important items in railway business.

The commerce of the port has been progressing during the past few years at the rate of 20 per cent. per annum, and there is every reason to expect a continuance of the progressive ratio. The residents in the Punjaub have shown a desire to procure their supplies by the Indus, in preference to the line of the Ganges, and in a few years their desire will in all probability be gratified to the fullest extent. An extensive Affghan trader, who has had dealings with Calcutta for years, having tried the Bombay market during the two past seasons, has given the latter the preference. Others will follow his example. These prospects of the Scinde trade lead me to believe that by the time a railway shall be laid down, and be prepared for action, our commerce will have doubled its present value, and the passenger traffic be ten times as much as it is at present.

To obtain data of a more accurate character than that now given, it will be necessary to adopt the Bombay plan for obtaining it, viz. to set Moonshees to watch the traffic by the principal roads in the direction of the proposed railway. The traffic on the river should also be noted, as well as the number of wayfarers passing by both the land and river routes. Everything, in fact, passing those roads should be noted; as the facts so collected may be made available for a railway statistic in some way or another.

The movement of Troops, and the transmission of Government stores, will, most likely, be effected by the railway; and the probable amount of employment by Government should also be ascertained from the departments concerned.

(Signed) J. MACLEOD,
Deputy Collector of Customs.

Kurrachee Custom House, 19*th October* 1853.

(True copy)

W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

Tabular View of the Returns of the Custom House, Kurrachee, Scinde, for the Official Years 1847–48, 1850–51, *and* 1851–52, *with a Contrasted Statement of the Increase and Decrease in Exports for* 1850–51 *and* 1851–52.

Names of Articles.	1847–48.		1850–51.		1851–52.		Increase in 1851–52.	Decrease in 1851–52.
	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.		
	Value.	Value.	Value.	Value.	Value.	Value.		
	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.
Alum	1,533	32	6,515	....	8,563	....	2,048	....
Almonds	3,919	18	4,700	1,025	3,157	2,105	....	463
Apparel, Hosiery, and Millinery	35,083	3,845	82,361	2,956	97,597	4,877	17,157	....
Bullion and Coins	2,150	7,73,719	12,870	4,919	14,097	8,810	5,118	....
Beads	412	37	1,464	619	1,648	918	483	....
Beer	77,225	....	1,39,956	301	1,55,219	870	15,832	....
Betelnut	11,995	380	9,280	3,142	17,630	2,227	7,435	....
China and Earthenware	4,947	575	17,027	1,015	21,285	502	3,745	....
Cochineal	14,236	35	23,361	....	44,490	....	21,129	....
Cocoanuts	46,425	....	6,959	1,013	15,500	973	8,501	....
Ditto dry	....	26	75,290	264	87,775	189	12,410	....
Coffee	6,409	....	5,001	....	5,066	....	65	....
Cotton, raw	1,13,453	4,760	52,217	3,285	94,883	3,909	43,290	....
Dates	1,22,955	12,937	1,06,603	6,726	94,535	3,314	....	15,480
Drugs and Medicines	13,795	23,934	33,214	28,906	41,061	23,470	2,411	....
Fishmaws	....	20,835	219	9,924	145	11,926	1,928	....
Ghee	2,184	7,268	30,569	22,879	3,307	96,161	46,020	....
Glassware	11,914	11,617	26,667	7,110	29,138	10,349	5,710	....
Grain of sorts	3,04,367	46,510	84,830	5,97,257	2,02,591	6,97,756	2,18,260	....
Gums	1,945	1,777	2,270	1,033	2,459	510	....	334
Gunnies	268	1,610	1,209	2,856	2,643	2,195	773	....
Horses, and live Animals	....	2,05,800	....	82,000	....	1,01,600	19,600	....
Hardware and Cutlery	12,616	1,219	89,109	1,880	75,382	1,648	....	13,959
Indigo	4,149	28,252	....	1,56,550	....	2,15,958	59,408	....
Ivory	11,233	174	11,745	211	17,864	1,310	7,218	....
Marine Stores	946	....	....	....	....	....	....	....
Metals	32,915	675	1,55,111	1,073	1,64,916	392	9,124	....
Oils of sorts	14,103	1,435	4,759	25,082	2,244	23,802	....	3,795
Carried over....Rs.	8,51,177	11,47,470	9,83,506	9,62,026	12,03,195	12,15,771	5,07,665	34,031

Names of Articles.	1847-48.		1850-51.		1851-52.		Increase in 1851-52.	Decrease in 1851-52.
	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.		
	Value.	Value.	Value.	Value.	Value.	Value.		
	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.	Rupees.
Brought over....Rs.	8,51,177	11,47,470	9,83,506	9,62,026	12,03,195	12,15,771	5,07,665	34,031
Oilman's Stores	3,881	....	49,759	4,076	56,363	223	2,751	....
Piece Goods, Cotton and Silk	9,22,064	12,881	15,60,297	17,161	18,70,958	39,213	3,32,713	....
Plate and Plated Ware	3,588	50	5,649	....	6,284	195	830	....
Precious Stones and Pearls	545	....	9,623	455	16,703	650	7,275	....
Perfumery	3,295	264	8,956	133	11,624	....	2,635	....
Sharkfins	....	9,039	298	15,613	50	17,607	1,746	....
Shawls	....	1,293	2,814	10,311	1,080	5,058	....	6,987
Silk, raw	67,107	537	1,50,500	1,225	1,17,063	5,196	....	29,466
Spice	61,656	427	1,12,801	585	1,88,029	183	74,826	....
Spirits	52,375	9,715	1,06,144	606	1,10,530	157	3,937	....
Stationery	18,050	133	47,634	455	51,756	2,543	6,210	....
Sugar	4,39,204	1,469	4,35,163	334	3,69,256	424	....	65,817
Sugar Candy	11,696	....	19,377	....	26,239	....	6,862	....
Tea..	32,739	....	27,108	128	51,200	150	24,114	....
Tobacco	31,980	5,430	34,600	111	51,582	877	17,748	....
Timber	12,421	....	24,478	4,684	40,980	248	12,066	....
Twist and Yarn, Cotton of sorts	47,900	337	1,40,820	216	1,39,481	453	48,898	....
Wines of sorts..	40,695	110	1,12,090	3,803	1,18,964	....	3,071	....
Wool	....	1,81,598	2,675	5,19,318	950	7,57,162	2,36,119	....
Woollens, British and Country	22,342	1,102	29,460	3,673	48,172	2,094	17,133	....
All Articles not enumerated above	2,56,005	1,75,453	3,94,764	4,19,805	3,61,743	3,93,024	....	59,802
Total....	28,78,720	15,47,308	42,58,316	19,64,618	48,92,202	24,41,228	13,06,599	1,96,103
						Less decrease.....	1,96,103	
						Net Increase for 1851-52....Rs.	11,10,496	

APPENDIX I.

No. 577 OF 1853.

To the SUPERINTENDING ENGINEER IN SCINDE.

SIR,

With reference to your letter No. 1066, dated 5th May last, I have the honour to forward a Return of Ordnance Stores,* with their gross weight, which have been forwarded from this Arsenal to the different Stations in Scinde during the last two years. I am unable to state the cost of the conveyance of these Stores, as they were *forwarded by the Commissariat Department.*

I have the honour to be, &c.

(Signed) R. C. WORMALD, Captain,
Commissary of Ordnance, S. D. A.

Kurrachee, 26th September 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

* This Return is not printed, as the gross weight of Stores in this Department is included in column 3 of the Statement forming Appendix E.

APPENDIX K.

No. 2019 of 1853.

To the SUPERINTENDING ENGINEER, Scinde Division,
Kurrachee.

SIR,

In compliance with the request contained in your letter No. 1067, of the 5th ultimo, I have the honour to forward a Return of all Stores* despatched by this Department to Central Upper Scinde and the Punjaub, from 1st May 1851.

This Department has been at no expense in the transmission of these Stores, as they were conveyed hence and from the mouth of the river by the Indus Flotilla, with the exception of a few boxes of medicine, sent by Government dooly-bearers.

I have the honour to be, &c.

(Signed) C. BIRDWOOD, Major,
Acting Assistant Commissary General, Scinde Division.

Camp Kurrachee, Commissariat Office, 21st June 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

* This Return is not printed, as the gross weight of Stores in this Department is included in column 3 of the Statement forming Appendix E.

APPENDIX L.

Statement showing the Number of Troops conveyed by the different Steamers and Flats of the Indus Flotilla between Kurrachee and Mooltan, and vice versâ, *between the 1st February* 1848 *and 30th April* 1853 ; *also the Number that marched from Kurrachee to Sukkur, and* vice versâ.

	Number.	Remarks.
Troops	28,022	These comprise Invalids, &c. from Upper Provinces, Treasure Guards, Escort Parties, Reliefs, and Recruits for the Punjaub.
Ditto	18,480	These comprise the Troops proceeded on Field Service, and Reliefs.
Years 5	46,502	
	9,300	Men per annum.

(Signed) JAMES L. EVANS, Lieutenant,
Deputy Assistant Quarter Master General.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

APPENDIX M.

Memo. of different Inquiries with a view to judging of the Cost per Ton per Mile of Land Carriage.

	Examples. [N.B.—The Maund is of 28 lbs., and 80 Maunds to the Ton.]	Rate per Ton per Mile.
	By inquiry in Kurrachee Town.	Annas.
	From Kurrachee to Kotree, 96 miles by hill route.	
1	Cloth, silk, and valuable goods, by camel, hire Rs. 4-4-0 to Rs. 4-8-0 (mean Rs. 4-6-0), load 7 maunds of 80 lbs. each	2.91
2	Grain of sorts, and groceries, by camel, hire Rs. 2-8-0 to Rs. 2-12-0 (mean Rs. 2-10-0), load 7 maunds	1.75
3	During the rains as above, hire Rs. 4-8-0 to Rs. 5 (mean Rs. 4-12-0)	3.16
4	By Bazar Master's nerrick, hire Rs. 4-8-0, load 6 maunds....	3.50
5	*By inquiry in Camp*, hire Rs. 2-8-0 to Rs. 3 (mean Rs. 2-12-0), load 6 maunds (journey 6 days)	1.42
6	According to Collector of Kurrachee, Rs. 10 per ton	1.66
	From Kurrachee to Sukkur, distance 290 miles.	
7	On camel, hire Rs. 6 to Rs. 8, (mean Rs. 7), load 7 maunds of 80 lbs.....	1.54
8	According to Collector of Kurrachee, Rs. 24 per ton..	1.32
	From Kurrachee to Sehwan, 146 miles.	
9	According to Collector of Kurrachee, Rs. 12 per ton	1.31
	From Kurrachee to Tatta, 61 miles.	
10	By Bazar Master's nerrick, camel hire Rs. 2-8-0, load 6 maunds	3.06
11	Ditto ditto ditto tattoo hire Rs. 1-8-0, load 2 maunds	5.51
	From Wagoda to Kurrachee by land, distance 14 miles.	
12	By camel, 7 maund loads, 12 as. to Rs. 1 (mean 14 as.)	4.00
13	By cart, 12 to 15 maunds, Rs. 1 to Rs. 1-8-0 (mean Rs. 1-4-0)	2.96
14	By camel, for karwa of 22 maunds, Rs. 1-4-0 to Rs. 1-12-0 (mean Rs. 1-8-0)	2.18

Memo. for River Traffic Cost.

	Examples.	Rate per Ton per Mile.
	From Wagoda to Kotree, distance 82 miles; distance to Kotree from Kurrachee 96 miles.	Annas.
1	Grain, groceries, &c., down trip, Rs. 7 to Rs. 8 (mean Rs. 7-8-0)..	0.41
2	Load 100 maunds, add Rs. 2-6-0 to Wagoda for 100 maunds	0.46
3	Load 100 maunds, up trip, Rs. 9 to Rs. 10, add landing and carriage to Kurrachee. [N. B.—Come down with a fair wind in 6 or 7 days, and go up, if well manned, in 25 to 30 days. Otherwise they may take 15 days on the down, and 45 days on the return voyage.]	
4	From Wagoda to Kotree for a karwa of 22 maunds weight, Rs. 2-4-0 to Rs. 2-8-0 (mean Rs. 2-6-0)	0.58
	From Kurrachee to Wagoda, 14 miles by land.	
5	Boat load 100 maunds, Rs. 2-4-0 to Rs. 2-8-0 (mean Rs. 2-6-0)..	0.76
6	Boat load 22 maunds, (1 karwa,) 12 as. to Rs. 1 (mean 14 as.)....	1.27
	From Sukkur to Wagoda, 276 miles; deduct Wagoda to Kurrachee.	
7	Boat load 100 maunds for grain, Rs. 11-12-0..	0.19
8	Ditto ditto for silk, cloth, and valuables, Rs. 25 to Rs. 35, 100 maunds ..	0.48
9	Charges of Indus Flotilla for Steam Agent Rs. 8-12-0 per ton per 100 miles up-river passage .. .. As. 1.40	
10	Ditto ditto at Rs. 5-11-4 per ton per 100 miles down-river passage 0.91	
	2) 2.31	
	Up and down stream (mean)....	1.15

W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

APPENDIX N.

Prices Current in the Districts during the Week ending 20th June 1853. *(Scindian, July 2nd,* 1853.)

	Doaba.			Nowshera.			Meerpoor.			Muhomed Khan's Tanda.			Habla.			Kurrachee Town.			Sehwan.			Ghorabaree.			Shah Bunder.			Shikarpore.			Sukkur.			Larkhana.			Mahur.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Wheat	0	14	0	1	1	6	1	2	0	1	5	0	1	0	0	2	0	0	0	14	6	1	6	0	1	5	0	1	0	6	0	10	10	0	14	10	0	13	8
Wheat Flour ..	1	3	0	1	4	0	1	8	0	1	14	0	1	4	0	1	10	0	1	4	0	2	0	0	2	1	3	1	1	8	0	14	6	1	2	6	1	4	3
Jowarree	0	14	0	0	14	0	0	13	0	0	13	0	0	14	5	....			0	13	9	1	0	0	0	12	0	0	12	9	0	13	0	0	12	0	0	12	3
Bajeree	0	14	0	0	13	0	0	15	6	0	15	6	0	13	6	1	0	0	0	13	9	1	1	6	0	15	3	0	11	0	0	11	0	0	10	10	0	11	6
Barley	0	10	0	0	14	0	0	14	0	0	12	0	1	0	9	0	11	0	0	11	3	0	8	1	0	6	3	....			0	9	2	0	11	2	0	9	5
Rice in husk, White.	1	2	0	....			3	1	3	1	12	0	1	5	0	....			3	5	4	1	5	0	1	5	3	1	1	9	1	4	0	1	4	6	1	2	9
Rice, Red	1	0	0	....			2	10	0	1	4	0	1	0	0	1	10	6	2	5	8	1	2	2	1	0	0	....			2	0	0	0	14	11	0	14	10
Rice	2	14	0	3	8	0	3	1	3	2	12	0	2	8	0	1	14	0	4	0	0	2	12	0	1	8	8	2	10	0	3	1	3	2	5	5	2	11	0
Gram	1	1	0	1	7	0	1	10	0	2	0	0	1	0	0	0	12	0	1	8	7	2	0	0	....			1	0	0	0	13	1	0	15	6	0	15	11
Jambha	0	11	0	0	10	0	0	10	0	0	12	0	0	14	0	1	15	0	0	11	10	0	13	0	....			0	11	9	0	14	6	0	10	4	0	9	0
Moong	1	8	0	1	12	6	1	12	0	1	8	0	1	8	6	0	11	0	1	8	0	1	8	11	1	4	0	1	13	6	2	13	0	1	8	9	1	7	10
Muttar	0	7	0	0	12	0	0	11	9	0	12	0	0	7	0	11	0	0	0	7	8	0	10	11	....			0	11	0	0	8	0	0	9	6	0	8	2
Cotton	10	0	0	10	0	0	10	0	0	12	8	0	9	0	0	18	0	0	10	0	0	12	8	0	13	2	0	8	14	0	10	0	0	8	5	0	10	6	0
Wool	10	8	0	9	0	0	7	10	0	14	0	0	10	0	0	11	0	0	11	0	0	8	0	0	4	6	0	12	15	6	12	8	0	10	14	10	10	10	0
Ghee	10	10	0	8	0	0	11	0	6	11	12	0	11	0	0	11	0	0	10	10	8	10	10	6	10	0	0	11	1	6	11	0	6	10	3	2	9	1	0
Indigo	83	14	6	60	0	0	1	12	0	70	0	0	60	0	0	65	0	0	80	0	0	80	0	0	65	0	0	57	8	0	60	0	0	60	3	2	60	6	8
Goor	4	0	0	....			5	0	0	4	12	0	4	4	0	4	12	0	5	0	0	4	0	0	5	0	0	3	14	0	4	4	0	3	9	0	4	1	4
Tobacco	....			....			3	10	0	....			....			....			....			....			....			....			....			....			....		

Remarks.

Taking the first item, or wheat, the profits derivable by the merchants from want of competition may be deduced as below. Take Sukkur and Kurrachee, the former place being on the river, distance by land 290 miles :—

Rs. 2 0 0 per maund at Kurrachee.
0 10 10 ditto at Sukkur.

Rs. 1 5 2 difference in price.
(Rs. 0 10 10 ditto = Rs. 37 0 8 per ton.
For carriage—Deduct 1 anna per ton per mile, or 290 as.... ... ... = 18 15 4 per ton at Sukkur.)

Rs. 18 14 8 remaining.
18 2 0

Being nearly 100 per cent. for profits and risk, which is exorbitant in the extreme.

W. C.

(True copy, corrected from the original Returns.)

W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

Kurrachee, October 1853.

APPENDIX O.

No. 482 OF 1853.

To LIEUTENANT W. CHAPMAN, Engineers,
On Special Duty, Scinde.

SIR,

I have the honour to acknowledge the receipt of your letter, dated 9th instant, and in reply to inform you, that the estimated amount per mensem for conveying the Mails between Kurrachee and Hyderabad, and *vice versâ*, is Rs. 2,000: this includes extra speed money, or remuneration for travelling within the time contracted for, viz. 7 miles per hour.

2. I would assume this to be the average monthly outlay for the next five years, which would amount to Rs. 1,20,000.

3. The above amount is solely a disbursement for the conveyance of the Mail.

I have the honour to be, Sir,
Your most obedient Servant,
(Signed) E. L. COFFEY,
Post Master in Scinde.

Post Master's Office, Kurrachee, 16th May 1853.

(True copy)
W. CHAPMAN, Lieutenant, Engineers,
On Special Duty, Scinde.

No. 456 of 1853.

Revenue Department.

From the COMMISSIONER IN SCINDE,

To the Right Honorable LORD VISCOUNT FALKLAND,
Governor and President in Council, Bombay.

Dated 16th November 1853.

My Lord,

With reference to paragraph 18 of my letter No. 459, of this day's date, I have the honour to submit, for the orders of your Lordship in Council, the copy of correspondence as per margin, on the subject of the railway project between Kurrachee and the Indus, and of granting an establishment to Lieutenant Chapman to enable him to lay down and survey the line in question during the coming season.

To the Superintending Engineer, No. 2836, of the 1st instant.
Reply from ditto, No. 2645, of 14th ditto, with enclosure.

2. I would very strongly recommend a compliance with the suggestion of Major Turner. It will save one, if not two years, in commencing the work; and when it is considered that Lieutenant Chapman's Report, just received, shows, that on the most liberal estimate of outlay, and the most moderate calculation of profits, a return of at least five per cent. may be secured from the present traffic over the line of railway, and that a Company is now forming in England to take up the line and provide the capital, I feel assured that Government would wish to have the detailed surveys before them as soon as possible.

I have the honour to be, &c.

(Signed) H. B. E. FRERE,
Commissioner in Scinde.

Kurrachee, Commissioner's Office, 16th November 1853.

No. 2836 of 1853.

General Department.

From the COMMISSIONER IN SCINDE,

To the SUPERINTENDING ENGINEER IN SCINDE,
Kurrachee.

Dated 1st October 1853.

Sir,

As Lieutenant Chapman has, I understand, nearly completed his Report on the subject of a canal to the Indus, and as the season for out-door operations is now at hand, I have the honour to request that you will instruct him, pending the receipt of Government

sanction, to commence such an examination of the country between this and Kotree as may enable him to select the best line for a railway, which I feel little doubt will prove preferable to any other mode of communication with the Indus, and to frame such estimates of the cost of a line, of the kind described in the lately published despatch of the Government of India to the Honorable Court of Directors on the general subject of railways, as would enable Government to decide as to the propriety of encouraging a private Company to undertake its construction.

2. This need not interfere with Lieutenant Chapman's visiting the Lukkee Pass, and planning and estimating a road over it; as, with the help of a steamer, which I have no doubt Captain Ethersey will be able to place at his disposal, the work will not probably occupy him many days.

3. In the execution of the survey between this and Kotree, it is very desirable that Lieutenant Chapman should put himself in communication with Lieutenant Steuart and Mr. Rassenrade, who is to undertake the survey of the frontier under Lieutenant Steuart's orders, as Captain Strange has urged in a letter, of which a copy will be sent to you, the extension of that survey, so as to provide a topographical survey of the country between the frontier and the Indus series of the great trigonometrical survey. The survey requisite for Lieutenant Chapman's operations will add largely to the surveyed portion of the country, and it would be a pity either to go over the same ground twice, or to omit to connect the one work with the other on either side of it.

I have, &c.

(Signed) H. B. E. FRERE,
Commissioner in Scinde.

Kurrachee, Commissioner's Office, 1st October 1853.

No. 2645 OF 1853.

PUBLIC WORKS. GENERAL DEPARTMENT.

To the COMMISSIONER IN SCINDE.

SIR,

I have the honour to transmit for your consideration a letter from Lieutenant Chapman, No. 58, of the 12th instant, on the subject of your letter No. 2836, of the 1st ultimo.

2. There can, I think, be no question, that if it be determined to construct a railway from Kurrachee to Kotree, it would greatly save both time and expense were Lieutenant Chapman furnished with the establishment he asks, and thus enabled, during the coming working season, not only to select the best line for the railway, but also to obtain the data for making an accurate estimate of its cost. Without the assistance asked, Lieutenant Chapman could do little more than examine the country, and, possibly, select the most eligible line, but with it he might, I think, have the line determined, and be prepared to let contracts for commencing the earth-works at all events at the beginning of the working season 1854-55.

3. The pay of the Assistants asked for would probably amount to Rs. 500* per mensem each.

I have, &c.

(Signed) H. B. TURNER, Major,
Superintending Engineer in Scinde.

Kurrachee, 14th November 1853.

* Inclusive of Military p^ys if in the Service.

No. 58 OF 1853.

To MAJOR TURNER,
Superintending Engineer in Scinde.

SIR,

I have the honour to acknowledge the receipt of your letter, No. 2433, of the 15th ultimo, with accompaniments, directing me to proceed to the Lukkee Pass, with a view to laying out and surveying a line of road in that locality.

This work I shall be prepared to undertake as soon as I shall have got my instruments and marching establishment in order.

2. I am further instructed, on the completion of the Lukkee road estimate, to proceed with the investigation of the railway project, and to lay down and survey a line of railroad from Kurrachee to the Indus.

To perform this latter work efficiently, and at the same time creditably to Government, and to myself, it seems hardly necessary to remind you that my present establishment of one Serjeant, having had little or no experience in such duties, is perfectly inadequate.

I can look to you only for the provision of such Assistants as will allow of the work being carried out in a satisfactory manner.

I beg to annex below a memo. of the assistance which is, in my opinion, necessary for the completion of a railroad survey during the approaching season :—

Two Assistants, either Officers from the Corps, or persons having received a practical education as Surveyors and Calculators.

Two Draftsmen, as Sub-Assistants, at Rs. 140 per mensem each.

One English Writer at Rs. 60 per mensum ; and such further establishment, beyond that already sanctioned, as may hereafter be found to be necessary, in the shape of Kullasees, Peons, &c.

I have, &c.

(Signed) W. CHAPMAN, Lieutenant,
Engineers.

Kurrachee, 12th November 1853.

(True copy)

(Signed) H. B. TURNER, Major,
Superintending Engineer, Scinde.

(True copies)

(Signed) B. H. ELLIS,
Assistant Commissioner.

No. 211 OF 1853.

FINANCIAL DEPARTMENT
(RAILWAY BRANCH).

To H. E. GOLDSMID, ESQUIRE,
Secretary to Government.

SIR,

In compliance with your endorsements on letters Nos. 456 and 459, dated 16th November, from the Commissioner in Scinde, with accompaniments, on the subject of

establishing a communication between the Indus and Kurrachee by a navigable canal, and an alternative project for effecting the same object by a railroad, I have the honour to offer the following remarks :—

2. I feel great diffidence in offering an opinion,—even a favourable one,—upon the merits of a plan drawn out and submitted, as it now is, in such minute and careful detail by Lieutenant Chapman, and after it has received the approval of an Officer of Major Turner's experience; and more especially in the present instance, where, setting other considerations aside, the opinions of an Officer regarding designs of this nature, formed on the spot, must ever be preferable to those derived from plans and reports by parties at a distance. I shall, therefore, merely say, that in my opinion, if the plans now submitted are adopted and carried out, the canal would fulfil all that is expected from it, and that in an economical point of view its probable advantages and returns have been exceedingly underrated by Lieutenant Chapman.

3. But the question now submitted for consideration is, whether, admitting the feasibility of the plan for establishing a communication between Jerruck on the Indus and Kurrachee by a navigable canal, the alternative measure of a line of railway from Kurrachee to Kotree is not, taking all points into consideration, to be preferred; and I must concur with the Commissioner in Scinde, Major Turner, and Lieutenant Chapman, in this latter view.

4. It is not necessary for me to enter into details on this question, which would merely be to recapitulate the reasons already brought forward in the accompanying Reports. No doubt it is an important advantage in the canal plan, viz. that whilst it provides communication, it would afford, at the same time, an unlimited supply of good water to Kurrachee, and also for purposes of irrigation at various points throughout its course; but, with this exception, all the advantages of speed, certainty, profit, &c. appear to be on the side of the railroad. As Mr. Frere observes, the very success of the canal would soon tend to call into action the rivalry of a railroad, which would at once endanger all the profits of the former, unless Government, which it appears to me they could hardly do, should undertake to promise a monopoly to the canal, by prohibiting the formation of a rail.

5. There is also much more risk in the canal plan than in that of a railway. As far as human judgment can go, the spot chosen for the head of the canal in the limestone rock at Jerruck is perfectly safe; but, in a costly work of this description, the treacherous nature of the river Indus must ever be borne in mind; and though there are no grounds at present for apprehending such a catastrophe, there is still no absolute certainty, that at some future period the river might not take a more easterly direction, and quit the foot of the Jerruck hills. Unlikely as this contingency is, still, if it did occur, it would render the whole costly work of the canal, in all probability, absolutely useless; whilst, in the case of a railroad, any alteration of the course of the river near the terminus could, at the worst, entail only the necessity of comparatively petty alterations. I would also, with every deference to Major Turner's and Lieutenant Chapman's opinions, submit, from what I remember of the nature of the country generally between Garrah and Kurrachee, that there are there some treacherous portions of country, across which the canal would have to be carried, and although the difficulty might by no means be insurmountable, I should fear, that from the nature of the soil below, and the material of which the banks would necessarily be composed, it would be a matter of no small engineering difficulty to keep the work secure and water-tight.

6. The consideration of the original project for a canal is now so intimately mixed up with the alternative one of a railroad, that it appears that the whole subject must remain undecided until that of the railroad is brought forward in such detail as will allow of a comparison of their respective merits. The present is the season for carrying on field operations in Scinde, and as this is rapidly passing by, and the loss of it must

entail a year's delay at least, I would beg most respectfully to submit for the consideration of Government, that Lieutenant Chapman should be furnished with the necessary means for completing at once the requisite surveys. Unless two Officers from the Corps could be at once sent up to join him, it would be necessary to sanction his procuring, if possible, in Scinde, the assistance he requires, viz. two Assistants, at a salary not exceeding Rs. 500 each, and two Draftsmen, at Rs. 140 each. The establishment of Kullassees, &c. might be drawn in a contingent bill.

7. In conclusion, I would beg to offer a few remarks on points connected with the proposed railway. In paragraph 12 of Mr. Chapman's report, he says "the gauge has been fixed at 4′ 8½″, as being that now, by common consent, most generally adopted." Without entering into any discussion as to the relative merits of various widths of gauge, I may mention that that chosen for the lines now in progress at the three Presidencies is a medium one of 5′ 6″; and although there is no absolute necessity for keeping to the same in any line west of the Indus, as the public could not at any future period be inconvenienced by such break of gauge, still, if only for uniformity's sake, it might be advisable in all Indian railways to adhere to one gauge, should no good reasons exist for adopting another in any particular instance. In laying out the plans, therefore, for the proposed line from Kurrachee to Kotree, I would recommend, unless there are reasons to the contrary, that the gauge of 5′ 6″ be adopted.

8. As regards sleepers, a large proportion of the line, where it may be surface line, or in cutting, would, I presume, from the facilities of procuring the material, be laid with stone blocks: these, certainly, do not make so easy and smooth a road as a line laid with wooden sleepers, but the economy would probably be great. Sleepers for the embankments, then, would only have to be provided for. And with reference to what Major Turner mentions respecting the ravages of white-ants, there seems reason to suppose, from our present experience on the Bombay and Tanna line, that the vibration of the passing trains is sufficient to deter that insect from attacking the wood, but longer experience is necessary to be quite certain on this point.

9. The last subject I would allude to is the supply of water. In laying out a line, too great care cannot be taken to ascertain the nature of the supply, not only as to quantity, but also as to quality. It is impossible to say to what extent the working expenses may be affected by this latter point; and on such a line as that from Kurrachee to Kotree, there might be instances in which it might even be worth while to make a considerable detour, so as to ensure a proper supply of good water at certain stations on the line.

I have the honour, &c.

(Signed) J. H. G. CRAWFORD, Captain,
Superintending Engineer, Railway Department.

Bombay, 2nd December 1853.

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